TRANSACTIONS

OF THE

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

VOLUME XIV

TRANSACTIONS

OF THE

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

Thirty-third Annual Meeting held at
The Hotel Jefferson, Richmond, Va.

May 2 and 3, 1921

Vol. XIV

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Williams & Wilkins Company
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In Memoriam

Dr. J. C. Felix Guyon, Paris

Died July, 1920

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THE AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

FIRST DAY, MAY 2, 1921

SOME ITEMS IN THE TECHNIC OF UROLOGICAL SURGERY

EDWARD L. KEYES, JR.

You could not possibly be interested in details of the operative technic, quite familiar to you already. But some of the minor guides may be not so familiar to all, and, what is perhaps more important, my recital may stimulate others to impart similar items, some of which are bound to prove suggestive.

I make no effort therefore to be comprehensive, but freely pass from topic to topic as these come to mind.

LOCAL ANESTHESIA

Local anesthesia is occasionally chosen to spare the patient the dangers of a general anesthetic. But as chiefly employed in the minor operations about the external genitals, local anesthesia might be classed as a convenience to the patient but an education to the surgeon. It requires of the young man that he keep his operative field clear of blood, that he know his anatomy, and, best of all, it encourages him to proceed camly, layer by layer identifying each as he cuts it. It has, moreover, the added advantage that the interne can be trusted to operate with local anesthesia not under the immediate eye of his visiting surgeon with far more impunity then if he were employing a general anesthetic.

But to proceed to more particular matters.

WILMS TUMOR

The illustrations herewith (fig. 1 and 2) depict the patient and the tumor removed a month or so ago by me. The child was five years of age, and with her tumor weighed 42 pounds, without her tumor 26. The tumor you will recognize is of the Wilms' type. It had been explored three months before the surgeon had declared the tumor inoperable after removing a section for diagnosis.

It was evident that the case was a desperate one, and indeed unfortunately the child died of shock twelve hours after operation. But the striking feature of the case, surgically speaking, was the ease with which I excised this 16-pound tumor, the whole front of which was adherent to the abdominal wall along the incision of the previous operation, the operation requiring less then twenty minutes' time. These enormous Wilms' tumors are very terrifying to look at, but come out very readily. They form few adhesions, and in spite of their malignency they may be shelled out like a cyst or a fibroid tumor. In this instance an elliptical incision was made from pubes to the ribs, carrying away most of the left rectus muscle to which the tumor was adherent. The central limb of the ellipse opened the intraperitoneum, the lateral one was extraperitoneal. The tumor was then thrown over toward the child's normal side, and readily shelled out. One vessel had to be tied under the diaphragm, and one clamp placed on the small pedicle of the kidney. Then the tumor was still further revolved forward and separated from the peritoneum up to its anterior parietal layer after which the peritoneum was divided and two ligatures to the deep and superior epigastric arteries concluded the operation excepting for the necessary through and through parietal suturing which was rapidly done with a straight needle and chronic catgut.

The technical point to be emphasized here is that the size of a tumor of a kidney does not prohibit operation. I have twice removed tumors of the carcinoma or hypernephroma type in adults whose renewal veins were very extensively infiltrated with the disease. Yet adhesion to the surrounding parts was not very great

in either one of these, and no particular difficulty was encountered. The wide incision through which the tumor is to be removed may be either transverse, or vertical. The Mayo's prefer the transperitoneal route with a vertical incision at the outer border of the rectus. I rather fancy the transverse incision, keeping extraperitoneal as far as possible, though entrance into the peritoneal cavity does not complicate the operation. Many years ago I operated upon a similar case but it had liquified, I broke into it, and had literally to bale it out. But it, too, was removable. I have seen but two other instances of tumor of this type. I got them out readily enough.

It should be remarked, of course, that operation upon this type of large tumor is scarcely a radical procedure. It is more in the nature of an effort to palliate the patient's sufferings. Only the the smaller tumors can be removed so radically as to insure against recurrence. But we may surely look forward to the day when the careful operations through wide incisions that are now so generally employed for the removal of neoplasms of the kidney will show excellent results. I have only twice seen neoplasms of the kidney early enough to do a satisfactory radical operation whereby the kidney could be removed with its surrounding fascia without encountering any adhesions or involvement of the renal vein. One of these, a carcinoma of the kidney, is now alive and well ten years after the operation. The other a Wilms' tumor, was operated upon, in conjunction with, Dr. F. J. Walsh whose case it was, and the child was alive when last seen three years after operation, and and apparently well.

THE SPERMATIC VEIN

The spermatic vein may be used as a guide in a number of operations about the kidney and ureter. It is, for example, an excellent guide to the position of the ureter, as it crosses the pelvic brim. The vein or group of veins is found attached to the peritoneum immediately external to the ureter. So that once the veins are identified the ureter is found just internal to them. Higher up it will be remembered that the two structure cross, the ureter going outward toward the kidney, the vein inward to empty

into the left renal vein, or on the right side into the cava just below the renal vein. Therefore, if in doing a nephrectomy one reaches the spermatic vein it is evident that the ureter has been passed, and must be sought external to this point. The spermatic vein can always be identified, so that, keeping outside of the spermatic vein, one is safe from injuring the vessels and can follow it up to the renal pedicle with the realization that all the tissue to be removed is external or anterior to it. In this way it is a very helpful guide.

THE DESCENDING BRANCH OF THE XII DORSAL NERVE

To some patients the anesthesia, pain and parasthesia following division of nerves in the course of an operation in the loin amounts to a complication of considerable gravity. This was called to my attention the other day by a young woman upon whom I had done a nephropexy four years ago for the relief of renal colics. Since that time she has been driving a motor ambulance and engaging in other athletics without any return of her colics, but with a constant sense of discomfort aud even pain in the loin which is evidently due to the division of the descending branch of the last dorsal nerve and which is of such severity that she was able quite conscientiously to say that my operation had done her no good though as a matter of fact before it she was bedridden for considerable periods of time, and since the operation has constantly been about and most of the time engaging in muscular exercise without any return of her colics.

In other words, the division of the nerve may be followed by discomfort of considerable importance to the patient. Now the usual oblique incision avoids the main nerve trunks if a little care is taken to look for them as the deeper muscles are divided, and unless it is carried unusually far forward does not catch the anterior branch of the last dorsal nerve. But the descending branch of this nerve which goes directly downward from the tip of the twelfth rib to across the iliac crest is about the midaxillary line is almost inevitably sacrificed unless the incision is carried very far backward so that it goes behind and below the iliohypogastric and ilioinguinal nerve, a rather inconvenient situation amounting to the old-fashioned vertical incision.

If the kidney is deeply situated or inaccessible by reason of adhesions, etc., one must, of course, quite boldly sacrifice this descending branch of the last dorsal nerve. And fortunately in about 50 per cent of cases the area of skin supplied by it is not very great. But one should always sacrifice it with regret, and if it seems unusually large it may be worth while to include its ends in a special suture as we close the abdominal wall, in order that the revitalization of the nerve may be encouraged, or it may be stripped free and not divided with the muscles.

THE USE OF ANTISEPTICS

There appears to be springing up in the consciousness of many men, partly as the result of the experiences of war surgery, partly as the result of actual operative experiences, the notion that it is wise to employ antiseptics in operative wounds that will probably be infected. Such, for instance, are lumbar wounds that open infected kidneys or suprapubic wounds opening infected bladder. It is traditional that such wounds require drainage; it is equally traditional that a certain proportion of them suppurate quite badly.

Of late I have made it a practice to bathe this type of wound with 1:5,000 acriflavine solution. The result obtained has been most extraordinary. The solution has not seemed to interfere with healing in any way, and does control suppuration to a most extraordinary degree. For example, I recently operated upon a carcinoma of the bladder in a woman seventy years of age with a large, pendulous, fat abdomen. The tumor was known to have existed for three years, its base was about 3 or 4 cm. across, it was treated in the usual manner by radium applications after excision of the projecting tumor, and it was foreseen that her fat belly wall was likely to suppurate for an indefinite period. With this in mind, the wound was protected throughout the operation by a roll of gauze that had been saturated in 1-5000 acriflavine. The abdomen was then sutured in the usual manner, allowing for a small drain in the bladder and to our great surprise it healed throughout by primary union, and it is worthy of note that though her convalescence was interrupted by an enormous carbuncle of the buttock, yet the abdominal wound never suppurated at all.

This case is merely cited as the most striking example of a result commonly attainable. I am aware that other antiseptics have been employed with similar purpose, and do not venture to compare acriflavine with them, but merely state that in this strength it has been most satisfactory in our clinic.

THE SCLEROTIC BLADDER NECK

The technical problem presented by the sclerotic prostate is perhaps as unsettled as any of the older problems of the urologist. Every sort of operation has been reported as curing certain cases of retention due to sclerotic prostatitis or contracted bladder neck, and if I may judge from my own experience with practically every sort of operation that has ever been suggested I think it is safe to say that some cases resist them all.

Let me immediately admit that I have no definite solution for for the problem. It is my belief, however, that we shall more quickly reach its solution if we divide all prostatic cases definitely into two classes. The one we may speak of as adenomas, and recognize as being that type of case that shells out quite readily, shows a generalized enlargement of the gland, and no contraction of the bladder orifice—rather a dilatation of this.

In the second class we may place the sclerotic cases (and we may possibly recognize a schlero-adenomatous class for many cases are difficult to classify precisely one way or the other). The purely sclerotic case has a bladder neck which is at least moderately tight to the index finger introduced into it from above. It often shows a middle lobe enlargement and not infrequently a slight enlargement of the lateral lobe within the urethra. Careful examination of these features of the prostatic enlargement is required. If we purpose doing a suprapubic operation, as I prefer, this examination may be made at the moment of operation. If not, the examination with the direct vision urethroscope is much more satisfactory than any other form of cystoscopic or urethroscopic examination. With this instrument we can appreciate the precise elevation of the bladder neck, the presence of the middle lobe and, what is even more to the point, the enlargement of the lateral lobes within the urethra.

Thus defining the sclerotic prostate and remembering that a middle lobe is very likely to be complicated by some such condition so that the removal of the middle lobe without relieving the contracture may do the patient no good whatsoever, we come to the three types of relief employed—the urethral, the suprapubic and the perineal.

The urethral operation began with Mercier, and closes with Caulk, including Chetwook, Young and Bugbee among the Americans who have contributed one or another form of operation. Of these urethral operations as a class it may be said they are likely to fail through destroying not enough of the obstructing bar. How great the obstructive bar is can well be appreciated only by those who do these operations commonly through a suprapubic opening and feel definitely what the obstacle is that they are attacking. Furthermore, these intraurethral operations fail entirely to attack the complicating lateral or median lobe enlargements.

I confess myself more interested in the suprapublic operation. The first essential feature of this operation is to introduce a finger into the urethra, tearing its orifice for that purpose if necessary, in order to identify with perfect definiteness whether there is any bulging of the lateral lobes. If there is, these are forthwith enucleated. This enucleation is very readily done if it is begun from the bottom of the urethra just behind the verumontanum instead from the top as is the custom when the adenomatous prostate is to be removed. Each little lobe is thus taken out separately. Then if there is a middle lobe, this is grasped either with a special ronguer forcep which tears the lobe away, or else with an ordinary ring forceps such as is used for holding gauze. This latter forceps has, of course, no very firm grasp and cannot be pulled upon. But with this the contracted bladder neck or base of the middle lobe can be studied while a V-shaped piece is cut out with scissors. When the middle lobe has thus been removed the finger is again introduced and the floor of the urethral entrance carefully palpated.

In many instances, one will find that there still remains a band of tissue across the floor of the entrance of the urethra. This band of tissue must also be cut away.

In the discussion of this topic at a recent meeting the remedies suggested for contracted bladder neck varied from the administration of potassium iodine to the dilation with the finger through a suprapublic opening, the use of the Young punch, the use of the Kollmann dilator and the total excision of the bladder neck. Evidently we have not yet reached an acceptable answer to this problem.

VARICOCELE

During the past two years a great number of operations for varicocele have been done on the Bellevue Hospital Service under the principle first enunciated by my resident of last year, Dr. U. C. Vincent.

The principle consists in nothing more than the suspension of the testicle by its pampiniform plexus veins to the external oblique aponeurosis. The object of this suspension is two-fold—in the first place the patient likes to see his testicle lifted up higher than its fellow having usually been greatly distressed notes that it was lower. In the second place many of these patients complain of all sorts of dragging discomfort in relation to the testicle and we have found that this discomfort is relieved by suspending the testicle to the external oblique through its veins, thereby taking all the pull off the vas deferens and surrounding structure.

This is the only operation, so far as I know, that actually relieves the discomfort associated with variococele.

The procedure is simple enough. Under local anesthesia a rather short incision is made centering over the external inguinal ring. The veins are identified and their sheath is split and the veins carefully separated. They are then divided, the upper end doubly ligated so that we be sure it shall not bleed. The lower end is then pulled upon and as it is pulled the fascial adhesions are stripped away from it until the testicle is seen to rise to the upper half of the scrotum. One then estimates how much slack will be needed to hold the testicle close under the pubes, estimating the leaving of it very high in the scrotum since subsequent to operation the veins will gradually stretch and the testicle sink down at least an inch lower than it is left at the time of operation.

At this point the veins are again cut and just below the point of cutting transfixed and doubtly sutured with chromic gut suture. Then with the blunt end of a pair of scissors, or the handle of a knife, the intercolumnar fascia is separated and this blunt instrument run under the aponeurosis of the external oblique for 3 or 4 cm. upward along the inguinal canal, separating the cremaster fascia from the inner surface of the external oblique. Then each end of the ligature that has been used to tie off the lower bit of vein is threaded separately on a needle and run into this inguinal canal and out through the external oblique in such a way that when pulled tight and sutured the veins are pulled up within the canal for the distance of at least an inch. With the tying of this suture the operation is concluded excepting the sutures necessary to close the skin.

One feature of this operation that is not to be neglected is the fact that it never causes hydrocele since the cord is never stretched down low enough to get anywhere near the testicle itself.

Many further items might be dwelt upon, but enough has been said we hope to encourage others to bring out their most interesting minor items of technic.

THE VALUE OF PREPARATION IN KIDNEY OPERATIONS

H. G. BUGBEE

New York

In reviewing the records, histories, clinical course, and post-operative life of eighty-three consecutive operated kidney lesions, certain facts have been brought vividly to mind.

Operative skill and oftentimes quick judgment at operation are essentials in the success of kidney surgery, yet unquestionably the outstanding factor, as emphasized in this series of cases, which leads to satisfactory results is the preparation of the patient for operation. Preparation means accurate diagnosis, and steps preliminary to operation which render the patient the best possible operative risk.

It is indeed out of place to bring before this body the technique of diagnostic procedures in kidney disease. The points which I would emphasize are that few renal lesions are primary, which signifies the necessity of a careful study of the individual, and that kidney lesions often give intermittent symptoms. These two factors emphasize the importance of protracted study.

Emergency operations upon the kidney are rare. They comprise some cases of traumatic injury, occasional infections when the patient has become septic, bilateral occlusion from ureteral injury, stone, or ligation, and obstructive lesions in a single kidney. All other cases of kidney lesion requiring formidable operative intervention may be studied carefully, over a period of time, and thus may be definitely prepared for the operation, which, in itself, should be classed as one step in the cure. Probably no operative procedure has brought so vividly before us the value of slow action in carrying out a radical

surgical procedure as the adoption of prostatectomy step by step, placing the simple enucleation of the gland in its proper place as an incident in the cure.

In kidney operations where we have two organs to fall back upon, one, in the large majority of cases, being a comparatively healthy one, there is a temptation to operate as soon as the diagnosis is made. My cases have proved to me, in my observations before, during, and after operation, in comparing the clinical course and results with other patients seen only in consultation and then rushed by the attending surgeon into operation, that preliminary study and careful consideration of each step is amply rewarded during and after the operative period.

The series of 83 cases to which I have referred includes 28 cases of renal tuberculosis; 27 cases or renal calculi; 7 kidney injury; 5 cases of pyonephrosis; 4 cases of prolapsed kidney; 2 polycystic kidneys; 1 congenital anomaly; 1 case of kidney infection complicating pregnancy; 5 bilateral lesions, and 3 tumors. While 83 is a small number from which to draw conclusions, these cases have been consecutive, occurring among several thousand patients seen with kidney lesions. Many that at first seemed unquestionably to be operative cases were prevented from reaching the operative stage by proper preparation, and many others seen in consultation only were operated by other surgeons.

In studying the vast number of kidney infections that come to us, two main factors present themselves: disturbed gastrointestinal function, and interference with kidney drainage. It is astonishing how many of these cases are cleared up by employing measures tending to improve the activity of the alimentary tract, by temporary kidney drainage with indwelling ureteral catheter and pelvic lavage. Kidneys with diminished function, showing, by functional tests and pyelograms, destruction of kidney tissue, putting out urine well loaded with pus and bacteria, clear up and go on at least as an aid to the other kidney. Many of these kidneys were sacrificed in former days, the underlying cause not determined, and the remaining kidney always in danger of a similar infection.

It is possible to say that, barring tuberculous infection, the presence of a calculus to maintain irritation, or some interference with drainage, there are few kidney infections that cannot be eliminated or greatly improved without operative interference.

Emergency operations, as previously stated, comprise some kidney injuries, infections with sepsis, lesions in single kidneys, and ureteral injury or occlusion, such as ligation. A question of fine judgment is often involved in the advocating of immediate nephrectomy in traumatic injuries of the kidney. Of the 7 traumatic cases operated by the writer, only 2 required immediate operation, nephrectomy. The remaining 5 were operated at varying periods of time after the injury. Of these 5, but 2 required nephrectomy; in the remaining 3 the kidney was saved, yet in each nephrectomy would have been done had immediate operation been carried out.

Operation in cases of prolapsed kidney, once resorted to in a large number of cases, soon fell into disrepute largely because the cases for operation were not well selected. Prolapse is a common condition, most often seen when an infection or a calculus is present, causing symptoms. Often there is a general visceroptosis. Improvement rapidly follows the institution of general corrective measures, the increasing of intestinal activity, and the employment of ureteral catheterization and pelvic lavage. The cases remaining for nephrorrhaphy are few. I have operated in but four. These were single movable kidneys, with ureteral kinks and definite crises.

Tuberculous kidneys constitute the largest number of cases requiring nephrectomy. In no class of kidney lesions is preparation for operation so important. These patients come to us in exceedingly poor physical condition, the majority presenting evidence of active or arrested foci in other parts of the body. In 85 per cent of the patients whom I have seen with tuberculosis of the urinary tract, the kidney focus was active at the time of the examination, with well marked bladder involvement and urgent urinary symptoms. Seventy-five per cent of all the cases I have seen presented some constriction of the ureter on the affected side. Few of these cases have been worked out at the

first cystoscopic examination. The pain experienced by the patient, the difficulty encountered in distending the bladder, and the presence of ureteral occlusion, rendered a prolonged examination inadvisable and unsatisfactory or impossible. The rapidity with which the symptoms improve, and the ease with which the case can be worked out in all its details at a subsequent examination, have proved to me the value of preparation for operation in these cases. Rest, increased elimination, favored by colonic irrigation, proper diet, flushing with fluids, and the administration of santal oil in doses of 10 minims every few hours, diminishing the amount as the symptoms improve, change the picture. Frequency and urgency diminish rapidly. The relief of the bladder symptoms must be due to the diminished activity of the tubercle bacilli, and to the clearing up of secondary infection, as well as to the increased body resistance. If the bladder lesion improves to such an extent the kidney lesion must become quiescent. I have found the renal lesion arrested in siix of the cases operated. A bladder which at the first examination could not be distended beyond 1 ounce will often, in from two to eight weeks under such general measures, distend to 5 ounces or more; the appearance of the bladder changes, so that often only localized lesions are visible; and a ureter partly occluded by stricture will open sufficiently when the congested mucous membrane has been shrunken, so that it may be easily catheterized. Under such changed conditions the patient will go through a nephrectomy with far less reaction, the wound will heal more rapidly, as well secondary ureteral and bladder lesions, and the danger of general infection will be reduced. I have performed nephrectomy in but twenty-eight cases of tuberculosis, but have seen many cases in consultation which were afterwards operated upon. In the majority of the latter cases nephrectomy was performed as soon as the diagnosis was made. In all of my cases I placed the patients upon preliminary treatment of from one to six months' duration.

Twenty of the 28 cases gave a history or presented evidence of foci outside of the urinary tract. Six had advanced pulmonary disease. In one, with both lungs involved, there was a

temporary lighting up of the pulmonary foci, and in another, with a large apical cavity, a hemorrhage followed operation; in each the reaction was of short duration. I have seen two cases of acute onset, with severe symptoms, operated as soon as the diagnosis was made, with no preparatory treatment, develop general miliary tuberculosis and die within two months.

Of the 28 cases, in 3 the wound broke down completely and healed slowly; in 4 there was a partial breaking down of the wound; in 2 a sinus opened after the wound was healed. In 19 the wound healed by primary union. Only 2 patients operated within the last year and a third two years ago, still have urgent bladder symptoms. The entire ureter was not removed in any case, and in no instance has a secondary operation been necessary. One patient developed epididymitis six months after nephrectomy. All are alive, some dating back twelve years.

All these patients, after operation, must be treated as cases of general tuberculosis. The results obtained in cases of renal tuberculosis from nephrectomy without preparation and postoperative care certainly reflect little credit upon the surgeon whose idea of a cure is the removal of the kidney and a live patient to leave the hospital—usually with an open sloughing wound, distressing bladder symptoms, and vitality at a low ebb.

Eighty per cent of the patients whom I have seen with renal calculi showed colon bacilli in the urine. Uniformly these patients have a disturbed gastrointestinal function, and they often have focal infections. Proper diet, increased intestinal activity, colonic irrigation, increased intake of fluids, clearing up of focal infections, together with ureteral catheterization, pelvic lavage, and possibly renal drainage by ureteral catheter, will vastly improve the general condition of these patients, as well as the kidney infection. I have found that patients with renal calculi, operated without preparatory treatment, have more postoperative distress from gastric and intestinal disturbances than any other class of cases.

Twelve patients with renal calculus, presenting a stone of appreciable size, for each of whom operation seemed inevitable, passed the calculus following manipulation with the ureteral catheter.

I would like briefly to contrast three cases which show the value of urological study and preparation.

A man, fifty-eight years of age, presented a renal calculus without infection. He had also a large adenomatous prostate causing frequency of urination, but he was still able to empty the bladder. He suffered from obstinate constipation and gastric distress. He was advised to have a period of preparation to improve his gastrointestinal condition, to relieve his prostatic congestion, and then to undergo pelvis-lithotomy, with careful attention to the prostate during the operative period. This patient went to a general surgeon, who removed the kidney stone at once. No attention was given to the gastrointestinal condition or prostate, and when I saw him two weeks later he had an open kidney wound, complete retention of urine, a very foul urine, loaded with pus and bacteria, abdominal distention, vomiting, a coated tongue, and a temperature of 104°. It then required four weeks of strenuous treatment, after preliminary bladder drainage, to prepare him for a prostatectomy.

Two patients presenting the same condition—renal calculus, one a single stone, the other multiple stones—and each with an enlarged prostate causing symptoms, were so much improved by ten days of rest in bed, diet, colonic irrigations, hot sitz baths, and urinary antiseptics, that they went through nephrectomy in one case and nephrotomy in the other with no complications whatever, one leaving the hospital on the tenth day after the operation.

In at least four cases a pelvic-lithotomy was substituted for a nephrectomy for calculus, this being made possible by preliminary treatment. Conservatism at operation, drainage of the kidney at the first operation, with secondary nephrectomy, saved two other patients who unquestionably would not have survived a primary nephrectomy.

Twenty-seven of this series of kidney operations were for calculi, twenty for single stones, 2 for large branching calculi, 3 for multiple calculi, and 2 for phosphatic concretions. There have been but two recurrences, this small number being due largely to postoperative régime and periodical examination.

But 5 patients were operated for pyonephrosis without calculi or tuberculosis. I have had 15 cases of pyonephrosis, shown by functional tests and pyelograms which have cleared up following catheter drainage and lavage, with general systemic care. The cases operated had preliminary treated, but failed to clear. Nephrectomy in each led to a rapid recovery, with only a small sinus in three cases, which rapidly closed, the other to healing by primary union.

In these cases of pyonephrosis, as in tuberculosis and calculi, when one kidney is to be removed the preliminary care goes far toward relieving the opposite organ of its load, and places it in better condition to assume the postoperative burdens.

In renal tumor probably less can be done in the way of preparation for nephrectomy than in any other class of cases. While an occasional early diagnosis may be made, as a rule these patients come to us with a large growth, operation doing little more than to prolong life in a small percentage of cases. One of my patients, with an early hypernephroma, is still alive six years after operation. A second, having a primary carcinoma of the kidney, died, three months after operation, of extreme carcinomatosis. An exploratory excision was made in a child fourteen months of age for a Willem's tumor, the case being found inoperable.

Few polycystic kidneys necessitate operation. Hematuria from this cause has been given as an indication for operation—kidney drainage and puncture of the cysts have been proposed. Of 8 cases of bleeding from a polycystic kidney (I have never seen bilateral hemorrhage in these cases), in all the bleeding stopped with rest in bed, ureteral catheter drainage and gentle lavage, increased elimination and intake of fluids, and urinary antiseptics. In all of the 8 cases a kidney infection was superimposed. I have operated 2 cases of polycystic kidney. In one a drainage was given to a large cyst that had become infected, and in the second a very large cystic kidney which was freely movable, giving great distress from ureteral kinking and intra-abdominal pressure, was removed. In the latter case the patient died eight months later of uremia.

During the past twelve years I have seen 67 cases of polycystic kidney, aside from the 2 cases mentioned above. I have seen 3 others operated, one drained, a second given bilateral drainage, and the third removed. The one given bilateral drainage died at once of uremia; the other two are alive. The one having a nephrectomy now has a large kidney on the other side, filling half the abdomen (six years after operation).

The many cases not operated are going on under the régime adopted in cases of interstitial nephritis. In these cases, while the diet is strictly adhered to, and intestinal elimination is satisfactorily maintained, a fair degree of health and activity is enjoyed.

Kidney complications during pregnancy are common. In many of these cases a preexisting urological lesion predisposes to infection. The added load thrown upon the kidneys, and the increased intraabdominal and pelvic pressure, bring about an acute condition; yet how few of these cases come to operation during or even after pregnancy, if properly handled. In no other class of cases is the demonstration so clear of what may be accomplished by establishing kidney drainage and lightening the burden, both by relieving an acute condition and eliminating operation. I have found it necessary to drain but one kidney during pregnancy, and here a perinephritic abscess had formed. In some cases the termination of pregnancy is warranted; in others, after passing through the pregnancy, the patient will require a kidney operation, as for the removal of a calculus, or a nephrectomy for a pyonephrosis.

Few congenital anomalies of the kidney come to operation unless the organ is the seat of a pathological lesion, such as calculus, tuberculosis, tumor, and, occasionally, pyonephrosis. Rarely, a malformed and malplaced organ, causing pressure symptoms, may be removed. I have operated in one such case.

Bilateral kidney infection is not uncommon. When complicated by calculus, operation for the removal of the calculi may be indicated, one kidney being operated at a time. All bilateral kidney lesions require most careful study and the institution of all measures tending to relieve or improve the situation before

operation is considered. In one patient first seen in a uremic state, with both ureters occluded by large ureteral calculi, I was able to dislodge one calculus by cutting the ureteral orifice, thus relieving the acute situation. Of five cases in which I have operated for bilateral lesions, all have been for the removal of calculi, and in each a period from one month to two years was allowed to elapse between the two operations.

In the 83 cases constituting this series there was no operative mortality, except in the child with the Willem's tumor, in whom an incision only was made. They were operated after all that could be done to improve their general and local condition had been carried out. Unquestionably in a considerable percentage of the series the patients were rendered better operative risks by this preparatory treatment. Such a preparatory period practically eliminates the old régime of a strong catharsis the night before operation, which assures the patient of an uncomfortable night and often stirs up the bad intestinal condition. It is my habit to give these patients who, by the care of days or weeks, have assumed a fairly active intestinal function, an enema on the morning of the operation. The operative area is shaved and $\frac{1}{8}$ grain of morphine is given one hour before, and repeated one-half hour before operation. All of my recent kidney operations have been carried out under gas-oxygen anesthesia. Nausea and vomiting are rare, and it is possible to resume nourishment at once, aided by saline per rectum. The temperature reaction has been slight and the postoperative course far smoother than when the preparation extends only over the night before operation.

The slow evolution of one's operative technique brings out certain points rather vividly. The ones I will mention are free incision, the one preferred being the straight lumbar, with forward transverse prolongation parallel to the crest of the ilium, separating the muscles, and splitting the lumbar fascia above, and a clean-cut of the abdominal muscles in the forward extension, avoiding the nerves. A free incision avoids unnecessary traumatism, permits a satisfactory delivery of the kidney, a good exposure of the pelvis for incising and suturing, an isolation of the

pedicle in nephrectomy, thus insuring accurate ligation and early removal or drainage when used. Two patients have died subsequent to operation, one three months later from carcinosis and one eight months later from uremia.

From my observations I am convinced that in cases of traumatic injury to the kidney conservative treatment or deferred operation, in carefully selected cases, will often lead to the saving of a kidney; that many cases of tuberculosis of the kidney, even in the presence of active foci in other parts of the body, will become good surgical risks by a careful period of preparation; that such a period of preparation diminishes the liability of general tuberculosis; and that secondary lesions in the urinary tract will heal more rapidly following operation. Careful preparation in cases of renal calculi often renders pelvio-lithotmy or nephrotomy possible, thus obviating nephrectomy. Operation has been eliminated in many cases of kidney infection and often even in pyonephrosis, by ureteral catheter drainage and cutting off the supply of infection to the kidney. The type of cases known as essential hematuria has been practically eliminated by more careful study and by pelvic lavage. Operative procedures in other kidney conditions, as congenital anomalies, polycystic kidney, tumors, and kidney complications of pregnancy, should be so accurately outlined and the patient so prepared for operation that the mortality in kidney surgery should be exceedingly small.

DISCUSSION

Dr. QUINBY: I wish to present my compliments to the authors of these very valuable and comprehensive papers.

In regard to Dr. Keyes' remarks concerning the operative procedure in the case of the intercostal nerves, I believe that it is easily possible to dissect these nerves back from under the rib, and by this posterior dislocation of them to keep them at the lower end of the incision where they will not in any way interfere with ready access to the kidney. It is very rarely indeed that I have found it necessary to cut either the ilio-inguinal or the ilio-hypogastric nerve.

I feel that I must take issue with Dr. Bugbee on one or two points; first in regard to tuberculosis of the kidney. Once the diagnosis is made and the value of the other kidney proven, I see no advantage to be gained in the usual case by waiting. The longer the kidney remains the more extensive do the bladder lesions become, and the more difficult are they to cure after nephrectomy has been carried out. Therefore it has been my custom to remove a tuberculous kidney at the earliest moment after the diagnosis has been made and the integrity of the other kidney proven. Regarding infection of the kidney not due to tuberculosis, there is no question but that considerable benefit may be obtained by conservative treatment, that is, by renal lavage. In the severer forms of infection this may have to be performed at rather frequent periods for a considerable length of time, and in certain instances I have been unfortunate in having been compelled, from two to three years after the patient had come under observation, to remove the kidney because of continued pain sufficient to necessitate a life of semi-invalidism. I think the attempt to save a kidney should always be made when the patient's social condition permits. If he can afford the time and trouble incident to palliative treatment, well and good; but if he be of the lower classes of society, dependent on his health

for his livelihood, he cannot afford the time for extensive treatment, but must submit to nephrectomy in order to get back to his job as soon as possible.

Dr. BARNEY: I feel that Dr. Bugbee's paper is very comprehensive. I feel, however, that he has slighted what I believe to be an important feature, and that is the question of the choice of an anesthetic.

Ether is often an unwise choice for it irritates the lungs of those with a chronic bronchitis and depresses the kidney function and kidney output of all and in cases where nephrectomy is done this is an important feature. Gas oxygen in the hands of an expert is harmless to the kidney but bad for the damaged heart and in many cases this organ is in a condition of doubtful integrity. Local novocain anesthesia will often suffice, at least for the first stage of a serious kidney operation. It is admirably adapted to the incision and drainage of a perinephritic abscess or even for the evacuation of the pus from a bad pyonephrosis. With the addition of a few whiffs of ether both of these procedures can be easily carried out. After the improvement of the general condition which should follow these operations has occurred, the nephrectomy or whatever is necessary can be done under either gas oxygen or ether with every prospect of success.

I believe that the choice of anesthesia is never stressed sufficiently but I think that success or failure often hinges upon it.

Dr. BUGBEE (closing): Polycystic kidney is a rather common condition. If one is constantly seeing a large number of kidney lesions, an average of six a year is small. Recently at our clinic at the Woman's Hospital three new cases were presented in a single day. In any case of abdominal tumor this lesion must be eliminated. The diagnosis of polycystic kidney may be simple or difficult. In many cases the diagnosis depends upon the interpretation of pyelograms. Functional tests are unreliable as in two of our cases with a phthalein output of over 70 per cent, and blood urea nitrogen content under 20 mil. per cubic centimeter.

I have never felt in any case of acute renal tuberculosis that ground was lost by waiting to make an accurate diagnosis and prepare the patient for operation—the clearing up of secondary infections, and amelioration of symptoms have given the patients comfort, allowed them rest and established a resistance for the operative stage.

The relationship between gastro-intestinal disturbance and renal infection in some cases is so close that often the kidney infection will clear up by simply treating the gastro-intestinal tract.

A CLINICAL AND PATHOLOGICAL STUDY OF CONTRACTED BLADDER

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The term contracted bladder is one which covers and includes a number of pathological conditions. It simply indicates a decreased bladder capacity, which may be due to lesions of various kinds. The distinction between the contracted bladder resulting from an acute inflammatory process and the type which is the site of a chronic inflammatory lesion is evident from a most superficial examination.

It is generally recognized that the majority of cases of bladder infection are secondary either to obstruction with or without residual urine or to some extravesical focus, such as the kidney, the seminal vesicles, the prostate or the sinus pocularis.

Every urologist is familiar with the rapidity with which a severe and resistant cystitis clears up following the removal of the primary focus. The bladder shows therefore a marvelous ability to eliminate infection once its source has been eradicated and this tendency is strikingly illustrated in many cases of tuberculosis. In most instances following the removal of the primary lesion, the inflammatory process in the bladder tends to heal provided it is not being reinfected from another focus. This peculiar ability of the bladder to take care of infection is so marked that some urologists have almost questioned the propriety of ever considering cystitis a clinic entity. This view is of course extreme, for after all outside foci of infection have beem eliminated, there will remain a fairly large group of cases, in which the bladder infection does not disappear spontaneously but which

responds to properly directed therapeutic measures. The cystoscopic picture in this group of cases shows a large range of variation, which includes a mere reddening of the mucosa, either localized or diffuse, areas of bullous edema, papillary formation and erosion or actual ulceration. Not infrequently in the same bladder, there may be a combination of all of these lesions. These cystoscopic findings usually signify only a mucous membrane lesion and give no index whatever regarding the degree or depth of the inflammatory process in the bladder wall. If the lesion is superficial and confined to the mucosa, it will usually disappear under local treatment. Those lesions which are resistant to irrigations or instillations will frequently be benefited by the application of strong solutions of silver nitrate. Where, however, this is difficult or impossible, the institution of daily hydraulic distension has in our experience yielded most gratifying results. In refractory cases where the lesion involves only the mucosa, systematic hydraulic distension with an attempt to increase the bladder capacity from day to day will gradually lead to resolution of the inflammatory process and a return of the bladder mucosa to normal. When, however, following the hydraulic distention, recontraction of the bladder occurs, one may be reasonably certain that he has been dealing with more than a mucous membrane lesion and that the pathological process involves the deeper layers of the bladder wall.

In these cases of cystitis, where the mucous membrane is involved, there is present in the urine varying amounts of blood, pus and bacteria. This is in striking contrast to the urinary findings in cases where the lesion is largely submucous. In this latter group the symptoms may be most distressing and severe and the pathological change in the urine slight or absent.

In 1913, Hunner reported a group of cases of marked contracture of the bladder. The symptoms presented by these patients were out of all proportion to the comparatively slight or negative changes in the urine and the cystoscopic findings often very indefinite. He made this report under the the title "Elusive Ulcer of the Bladder." They really represent a group of cases in which the mucous membrane lesion has

disappeared, the predominant pathological factor being the inflammatory process in the deeper layers of the bladder wall.

Nitze had previously described apparently the cystoscopic picture in this form of cystitis and since Hunner's report, Geraghty, Keene and more recently Kretschmer and Bumpus have called attention to this pathological condition.

It should be noted in this connection that Nitze's description of the condition consists simply of a cystoscopic observation. To Hunner belongs the credit, not only for making a careful study of the condition but for having first proposed and successfully carried out in a considerable series of cases a rational surgical procedure.

The value of Hunner's work, which was carried out independently of the observation of Nitze, is emphasized upon reflection, that up to the time of his report, the pathological significance of this not uncommon lesion was unappreciated and all efforts directed toward a relief of the condition unavailing.

During the past five years, twenty-six cases presenting this lesion have been treated in the Brady Urological Clinic. In this series only three have occurred in females. The small proportion of women is probably explained by the fact that the great majority of cases treated in the clinic are male. The cases reported by Hunner and Kretschmer all occurred in females but Bumpus has recently reported five cases occurring in the male. It seems probable that the condition occurs with about equal frequency in both sexes.

Of the twenty-six patients with this type of contracted bladder, the ages were as follows.

Ten to twenty years	1
Twenty to thirty	4
Thirty to forty	6
Forty to fifty	7
Fifty to sixty	8

SYMPTOMATOLOGY

It is at once evident from a study of the cases comprising this series that the most prominent symptoms are urinary

frequency and pain. These symptoms were present in every case and their duration ranged from four months to nineteen years. The frequency in eleven of the cases was extreme, amounting almost to incontinence, the patients having an almost constant desire to void. This symptom was present both day and night, although in the majority of cases it was somewhat more aggravated when the patient was up and about.

In four of the cases there was definite obstruction to urination, all of them having contractures of the vesical orifice. In two others the urinary stream was frequently interrupted, probably due to spasm of the vesical sphincter.

Severe suprapubic pain, when the bladder is allowed to distend, has been a symptom common to all of the cases. In some cases, this has been referred to the right or left of the midline, subsequent examinations showing the lesion in the corresponding half of the bladder. The pain on distension has usually been described as severe or cutting.

Many of the cases have noted an intensification of the suprapubic pain at the beginning of urination, while others have experienced a burning sensation in the neck of the bladder, perineum and glans penis at the end of the act which sometimes persisted for several minutes. In one case, this was associated with marked urgency and an intense desire to void more urine. In only one case was the pain during urination referred to the rectum.

A history of hematuria coming on independently of instrumentation was elicited in seven cases. In one of these it was quite profuse and followed exertion. Another case gave a history of passing a small clot two weeks before admission. Two others volunteered the information that they had noticed slight hematuria occasionally while in the remaining four cases the hematuria was terminal and usually associated with marked straining at the end of urination.

In ten of the cases, the urine was negative for pus and microorganisms, while the urine in four of the cases showed on centrifuging a few leucocytes and red blood cells. The remaining sixteen cases showed varying amounts of pus and micro-

organisms, the infection in fifteen being a bacillus, while in one case a staphylococcus was found. In only one of the cases was the presence of renal infection demonstrated, this case having unilateral pyelitis, which cleared up on pelvic lavage. In two of the infected cases in the series, ureteral catheterization was not carried out.

The history of gonorrhea was obtained in eight of the cases, but in only two did this infection bear any time relationship to the development of the bladder symptoms. In one of these cases the gonorrhea was complicated by acute epididymitis. At the end of three months urinary frequency, urgency and terminal hematuria began. These symptoms persisted despite treatment, gradually becoming more pronounced and at the time of his admission three years later, his bladder symptoms were extreme.

Another patient whose gonorrheal infection was apparently complicated by an acute posterior urethritis and trigonitis had been operated upon eleven years later for urethral stricture, an external urethrotomy being done. His bladder symptoms had begun two years after his gonorrheal infection and had gradually progressed, being unrelieved by the cure of the urethral stricture.

CYSTOSCOPIC FINDINGS

A constant and prominent feature of all the cases is a diminution of the bladder capacity, together with the production of severe suprapubic pain when an attempt is made to introduce fluid beyond this amount. At the original examination of these twenty-six cases the bladder capacity was as follows:

50 cc. or under	9
50 cc. to 100 cc	7
100 cc. to 200 cc	7
200 cc. to 300 cc	3

The cystoscopic appearance of the lesion varied considerably. In twenty of the cases the change in the mucosa was very slight, the patient's symptoms being out of all proportion to the apparent insignificance of the lesion. The lesions were frequently so indefinite that but for the fact that the condition was sus-

pected, it might easily have been overlooked. A slight or intense reddening of the mucosa, ranging from a few millimeters to several inches in diameter was frequently the only abnormality noted. In other cases close inspection of the lesion showed a definite puckering, indicative of a fibrous change in the submucosa. The center of this type of lesion is often paler than the periphery which may be intensely red. Not infrequently during the cystoscopy the lesion which at first was quite indefinite becomes very much more evident. It is now intensely red and often appears slightly elevated above the surrounding mucosa. When the bladder, which is the seat of such a lesion, is subjected to marked distension, bleeding at the site of the lesion invariably occurs. The mucosa which, up to this time, has been intact, now shows bleeding fissures which at subsequent cystoscopies are seen to be covered with muco-pus. In certain cases, particularly those having an infected urine, a definite ulcer may develop at this point.

In four of the cases, definite ulceration was noted, the ulcer being irregular, superficial, covered with muco-pus and surrounded by a zone of hyperemia and edema.

In thirteen of the cases the lesion was single, in seven two lesions were found, and in three, three or more inflammatory areas were noted. The location of the lesion was anterior wall ten cases, antero-lateral walls two, lateral walls six, and posterior wall five.

In three of the cases the bladder contraction was extreme, the capacity being less than 30 cc. When an attempt was made to introduce more fluid, bleeding occurred. From the view obtained, the mucosa was everywhere thickened and intensely inflamed but no definite ulcerations were noted.

In another case, in addition to the above findings, a small ulcer was found on the anterior wall.

DIAGNOSIS

While the symptomatology of no bladder disease can be considered pathognomonic, the symptoms presented by patients suffering from this type of contracted bladder are certainly very

valuable leads to diagnosis. The history of long-standing frequency and suprapubic pain on bladder distension, in the absence of any symptoms of obstruction, is strongly suggestive of the condition, particularly in those cases having an uninfected urine. The marked contraction of the bladder, the reproduction of the pain complained of by the patient and the cystoscopic findings complete the diagnosis. In these cases in which no actual ulceration is present and in which the lesion is quite indefinite, over-distension of the bladder will frequently cause bleeding at the site of the lesion and aid in its localization. We have noted not infrequently that many lesions which were very indefinite cystoscopically became most striking when the bladder was opened at operation. The area of involvement not infrequently presents deep bleeding, often irregular fissures, which extend into the sub-mucosa. In some cases in which the bladder has been greatly distended, the mucosa and submucosa may be missing throughout quite large areas.

The marked difference between the cystoscopic appearance of the lesion and that at operation is very probably due to over-distension, sponging, etc. It is impossible therefore from the the cystoscopic appearance to form any accurate idea of the extent of the lesion, which is so intensified when the bladder is opened.

PATHOLOGY

In fourteen cases operated upon, the bladder showed more or less thickening of its wall. In some of these cases, it was extremely thick at the site of the lesion, the inflammatory process having extended through the coats of the bladder and not infrequently involving the perivesical tissues. In eight of the cases, the bladder wall was quite thin, being only very slightly thicker at the point of inflammatory involvement. The lesion in these cases was therefore confined to the sub-mucosa.

Study of the epithelial changes are quite unsatisfactory, as one rarely obtains a specimen in which the epithelium is intact and it is unsafe to draw conclusions regarding the partial loss of epithelium unless one is able to remove the specimen

without in any way traumatizing the surface of the tissue removed. The epithelium of the bladder mucosa is rubbed off with very slightest trauma. Before one can depend upon the microsocopic changes in the epithelum, it would be necessary to harden the specimen in situ. We have not been able to obtain a specimen in which we could speak with any certainty that the loss of epithelium bore any relation to the lesion.

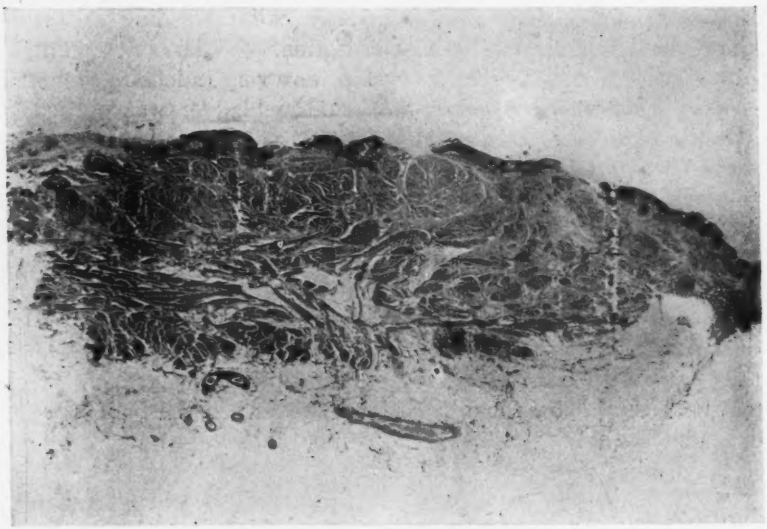

FIG. 1. PHOTOMICROGRAPH OF OPERATIVE SPECIMEN SHOWING A THICKENED SUBMUCOUS FIBROUS LAYER WHICH IN PLACES HAS BEEN TORN AS A RESULT OF OVERDISTENSION OF THE BLADDER

The striking and important lesion in all of the cases in which the tissue has been studied has been a fibrosis of the sub-mucosa, the thickness of the layers varying considerably. The mucous membrane in these cases rests directly upon the dense scirrhous layer instead of, as in the normal bladder, upon the loose areolar tissue.

When the bladder is over-distended in these cases, the mucous membrane cracks as this fibrous layer is inelastic. In most cases

beneath this fibrous lamella there is round celled infiltration of varying degrees of intensity, in no way dissimilar from ordinary cases of chronic cystitis. Sometimes the inflammatory process can be followed down in between the muscle layers and even as far, in exceptional cases, as the serous coat. Where this deep invasion occurs one usually finds the lesion thick-walled. In those cases in which a chronic inflammatory process is limited to sub-mucosa, it is usually found that the bladder wall is rarely if any thicker than normal. In most cases a marked congestion and dilatation of the blood vessels and extravasation of blood in the tissues are observed. How much of this is due to trauma is difficult to decide.

The associated and constant lesion in the disease is apparently the sub-mucous fibrosis, sometimes thick, sometimes thin, rarely if ever replacing the areolar tissue entirely. This layer is extremely dense in most cases. The microscopic picture as a whole differs scarcely at all from the average changes seen in simple chronic cystitis, except in the formation of the fibrous submucous layer.

TREATMENT

Experience has shown that nothing short of operation has accomplished any permanent results in those cases in which more than the bladder mucosa was involved. In cases therefore in which the findings are such as to indicate an involvement of the submucous or deeper layers, it is futile to temporize with conservative treatment. If the lesion lies in portions of the bladder which can be resected, this operative procedure is to be recommended. If, however, the areas of involvement cannot be removed, deep cauterization should be practised.

If the findings on cystoscopy make it difficult to differentiate between a superficial lesion and one involving the deep layers of the bladder, a conservative course of treatment, such as vesical distensions, instillations and irrigations may be employed. This plan of treatment in our hands, however, has proved most unsuccessful, so far as permanent cure is concerned.

In certain cases in which the entire bladder is involved in this process, which are complicated by superficial ulceration, removal

of the ulcer will not infrequently relieve the patient's pain, although only slight improvement, so far as urinary frequency is concerned, can be expected.

As we have previously stated, these lesions resolve themselves into two types, one in which the bladder is thin, the pathological lesion involving principally the submucosa. In some of these

FIG. 2. PHOTOMICROGRAPH SHOWING A THIN AND INTACT LAYER OF FIBROSIS LYING UPON A SOMEWHAT THICKENED SUBMUCOSA

The bladder in this case was not subjected to overdistension preliminary to operation.

cases, the lesion occupies so large a portion of the bladder that resection is either too hazardous or impossible. In these cases deep cauterization with destruction of the mucosa and sub-mucosa has resulted in marvelous improvement and cure. It has further been our experience that where the bladder is thick-walled and where the lesion involves all the layers of the bladder wall, the area of involvement is usually localized and

usually lends itself admirably to resection. Further experience may show that deep cauterization alone may be sufficient to effect relief of the condition present. We have not felt justified, however, in cauterizing where resection has been possible.

The type of treatment carried out in this series of 26 cases may be summarized as follows: Twenty -two of the cases were operated upon and in four the treatment consisted solely of vesical distensions, instillations, fulguration and the application of silver nitrate to the area involved. Fifteen of the operated cases were treated by resection while in four, because of the extent of involvement and the fact that the lesion was apparently superficial, deep cauterization was employed. In one of the earlier cases an extensive although superficial area was treated with the silver nitrate stick. In three cases in which the process involved practically the entire bladder, an associated contracture of the vesical orifice was found. This was relieved by a punch operation and the bladder mucosa which was thickened and inflammed was thoroughly curretted. It is interesting to note that of the eleven cases treated conservatively, seven were subsequently operated upon.

RESULTS

The results in the fifteen cases in which radical excision of the inflammatory area was carried out show in thirteen complete relief so far as pain is concerned. In seven there is normal frequency of urination while in the remaining six, in all of which there was a diffuse cystitis, more or less urinary frequency persists. Two of the fifteen patients died following operation, one of bilateral pyelonephritis, the other of paralytic ileus.

In five of the cases treated by cauterization, the results in four are encouraging for this type of treatment in selected cases. The one failure was a case proved subsequently to have a lesion involving all of the layers of the bladder wall. Cauterization in this case was followed by no improvement and resection has recently been carried out.

In two women of the series, one of whom was treated by resection, the other by cauterization and resection, operation was

followed by more or less obstruction to urination as evidenced by the development of residual urine of from 100 to 200 cc. In one of these cases the condition was thought to be due to contracture of the vesical orifice and improvement followed a partial division of the sphincter. In the other case the cause of the retention was not determined.

The four cases in which the treatment consisted solely of hydraulic distension and local applications, there has been marked improvement in urinary frequency and pain. In none of these, however, has the improvement been permanent and it seems probable that a complete cure will not be realized until more radical measures are instituted.

The following cases are cited as illustrative not only of the symptomatology and pathological findings of this condition but the response to various methods of treatment.

Case 1. No. 9272. Male, age twenty-seven. This patient was first seen December 9, 1920, his complaint being frequency and painful urination. This patient's urinary symptoms dated back to May, 1915, at which time he began to have some urinary frequency and pain which was referred to the neck of the bladder. The pain was usually more marked as the bladder was emptying and would sometimes last for three quarters of an hour after urination. He gave a history of only one attack of hematuria. During the year prior to his admission, his frequency became somewhat more marked, it being necessary for him to void at hourly intervals. He suffered also from some suprapubic pain on vesical distension, as well as pain in the neck of the bladder during urination.

On cystoscopic examination the bladder capacity was 100 cc. On the anterior bladder wall, just behind the prostatic orifice, were two very definite ulcerations measuring about 3 cm. in diameter. The region of the ulceration was slightly elevated and the mucosa in the immediate vicinity intensely red. Study of the bladder urine showed no infection.

During the following six weeks the patient received daily vesical dilatations, and his bladder capacity increased to 375 cc. and there was marked symptomic improvement.

Cystoscopy on February 11, 1921, showed some improvement in the appearance of the lesion on the anterior bladder wall, although there was still slight ulceration and reddening.

Patient was last heard from April 1, 1921. He had been quite comfortable until one week before when he had a gradual return of urinary frequency and pain.

Case 2. No. 5289. Male, aged twenty-three, admitted July 1916. This patient gave a history of two attacks of gonorrhea, one in 1910 and the second in 1915. He stated as long as he could remember, he had had some urinary frequency but that during the year prior to his admission his bladder had become very much more irritable. He was, however, able to hold his urine for an hour during the day and one and a half hours during the night, although when asleep he frequently had slight incontinence. When the bladder became distended, he suffered from some suprapubic pain.

Cystoscopy: Two small red areas were seen in the region of the air bubble. The remainder of the bladder appeared to be quite normal. Study of the patient's urine showed some pus and bacilli. Attempt at ureteral catheterization was not successful.

This patient received daily treatments consisting of hydraulic distensions of the bladder and at the end of two weeks his capacity was 110 cc. He was seen two years later, at which time there was some improvement in his former symptoms.

Cystoscopy at this time revealed lesions on the anterior wall which were practically identical to those seen on the first admission. His bladder capacity was 80 cc. The patient received bladder dilatations for the following two weeks and his bladder capacity was increased to 130 cc. He was advised to continue his dilatations daily.

This patient was heard from in April 1921. He reports his condition as improved but states he is able to hold his urine for only two hours during the day and night. He is now complaining of pain in the suprapubic region, when the bladder is allowed to distend and at the end of urination.

Comment: The employment of daily hydraulic distension with local treatment consisting of direct application of strong silver nitrate or the high frequency spark to the site of the lesion has, in many instances, resulted in marked symptomatic improvement with an increase in bladder capacity approaching normal. In all cases, however, in which subsequently the lesion had been proved to involve layers other than the mucosa, there has been a recurrence of symptoms and the patient has presented a clinical

picture similar to or worse than originally noted. This type of treatment is applicable therefore only to those cases in which the mucosa is alone involved.

Case 3. No. 9600. Male, aged sixty-five, admitted April 13, 1921, with the history of having an attack of urinary frequency associated with pain in the suprapubic region and the deep perineum a year previously. These symptoms persisted and during the six months prior to his admission, he was voiding every few minutes, the bladder, if allowed to distend, causing him extreme suprapubic pain.

On examination, the bladder was found to have a capacity of less than 60 cc., the patient complaining bitterly when more fluid was introduced. Under ether anesthesia a considerably greater capacity was obtained and a fairly satisfactory cystoscopy carried out. On the posterior bladder wall was a large area of papillary cystitis. The lateral walls while edematous were not particularly red; the bladder urine was rather badly infected.

At operation on April 15 the bladder was subjected to rather marked overdistension, and upon opening it the mucosa of the posterior bladder wall over a large area was irregularly torn and bleeding, a picture more or less typical of these lesions when the bladder is overdistended. Because of the extent of the lesion together with the fact that the bladder did not appear to be very thick-walled, suggesting a rather superficial lesion, a resection was not attempted, the lesion being vigorously burned with the electro-cautery. Investigation of the vesical orifice showed a rather marked contracture which was relieved by a "punch."

The suprapubic wound has now been healed three weeks and the patient is voiding at normal intervals without pain.

Case 4. No. 7114. Female, aged forty-two, first examined on August 5, 1918. Her urinary symptoms dated back fifteen years at which time, two weeks after childbirth, she experienced great difficulty in voiding. She noticed no further trouble until the last year, during which time she had suffered intense pain and spasm in the suprapubic region, particularly when the bladder became distended. There had also been very marked frequency of urination, it being necessary for her to pass her urine every few minutes. She gave no history of hematuria except on one occasion following a bladder irrigation. Since the onset of her recent symptoms, there has been no hesitancy or other obstructive symptoms.

Her general physical examination was quite negative. The bladder urine was grossly clear but on microscopic examination a few pus cells and B. coli were found. On cystoscopy, the bladder capacity was less than 50 cc. On the posterior bladder wall there was an intensely red area, slightly elevated, more or less circumscribed, and scattered here and there with tiny, superficial ulcerations.

At operation on August 9, 1918, it was found that under ether the bladder capacity was 300 cc. On examination there was found on the anterior wall, to the left of the vesical orifice, a localized, intensely red area. Another smaller area was found on the posterior wall, between the two ureters. This latter area involved a portion of the trigone and extended posteriorly for some distance. No definite ulceration was made out at operation. The remainder of the bladder was normal. Because of the position of the inflammatory area on the floor of the bladder, which involved a portion of the trigone, it was considered inadvisable to excise this area. The area to the left of the vesical orifice was resected and the large area on the posterior bladder wall was thoroughly cauterized.

The portion of bladder wall resected was little if any thicker than normal. Microscopic examination of the section shows an absence of the bladder epithelium. Throughout its entire extent is seen a very thin, apparently dense area of fibrosis replacing the more superficial layers of the submucosa. This in places is torn and ragged, apparently the result of overdistension. The remainder of the submucosa which appears to be somewhat thickened shows many dilated vessels and in areas rather dense infiltrations of small round cells.

The post-operative course was quite uneventful and at the time of her discharge on October 2, 1918, the patient was symptomatically very much improved. She was free from the pain she had suffered before operation and her bladder capacity was 90 cc. Her bladder urine was quite cloudy and it was thought at the time that her diminished bladder capacity may have been caused by the cystitis resulting from the suprapubic operation.

The patient was again seen on May 15, 1919. Her bladder was no longer painful but the suprapubic incision which had broken open on several occasions was now draining a small amount of urine. The patient voided 130 cc. of urine.

Cystoscopy at this time showed the bladder in the region of the trigone to be quite irregular with a septum formation to the left of the midline in the region where the resection was done. The bladder mucosa

was quite pale, there being none of the red areas seen originally. The condition was thought to be one of contracture of the vesical orifice in view of the fact that about 100 cc. of residual urine were found. Her treatment at this time consisted of high dilatations of the vesical orifice and at the time of her discharge, November, 1919, the suprapubic wound was healed. The patient was able to void at the time of her discharge 90 cc. but on being catheterized immediately after 130 cc. of urine were obtained, the bladder capacity therefore being 220 cc.

The patient again returned to the hospital March 19, 1920, the suprapubic fistula having reopened a short time after leaving the hospital. Her residual urine at this time was in the neighborhood of 200 cc. She suffered from practically no pain in the region of the bladder. The vesical orifice was divided with the punch instrument and at the time of her discharge, the suprapubic wound had been healed for four days, and the patient was emptying her bladder completely. She was able to hold her urine two and one-half hours without pain.

Comment: This case was treated by a combination of cautery and resection. A study of the specimen removed, however, suggests that a favorable result would have followed the employment of the cautery alone. Operation in this case was followed by symptoms of urinary obstruction and the development of residual urine, a post-operative complication noted in another woman in the series having an extensive resection. The condition in this case was thought to be due to contracture of the vesical orifice, as marked improvement followed high dilatations and partial division of the sphincter. The cause of the obstruction in the other case was not determined.

Case 5. No. 5751. Male, aged forty, was first seen in February, 1917. He gave a history of an attack of gonorrhea in 1905 which was complicated apparently by acute posterior urethritis. Two years later he developed symptoms of urinary obstruction and was operated for urethral stricture ten months before admission. In February, 1915, he began to suffer from urinary frequency and dysuria, together with marked suprapubic pain on vesical distension. There is no history of hematuria.

On cystoscopy, there was no residual urine and the bladder capacity was 100 cc. On the left lateral wall of the bladder, midway between the apex and the vesical orifice, the mucosa over an area measuring 2.5 by 3.5 cm. was elevated and the seat of a hemorrhagic and papillary

cystitis, in the center of which was a small area of ulceration with adherent muco-purulent material. On distension of the bladder to 100 cc., this region bled quite freely. This lesion was considered suspicious of tuberculosis and this view was apparently strengthened by the presence of considerable pus in the bladder urine without demonstrable pyogenic organisms. Repeated studies of the bladder urine, however, were negative for the tubercle bacillus and ureteral catheterization ruled out the possibility of renal tuberculosis.

At operation on March 14, 1917, after the peritoneum had been pushed back so as to expose extravesically the left lateral wall, the operator could feel distinctly the area involved in the inflammation. The perivesical tissues were adherent at this point and in addition a distinct induration could be detected in the bladder wall. Upon opening the bladder, the area noted at cystoscopy showed an irregular margin and a surface intensely red and bleeding. It was quite readily excised, the specimen measuring 6 cm. in diameter. The remainder of the bladder was normal. The defect was then repaired by a continuous catgut suture and the bladder drained by a rubber tube inserted at the apex.

Pathology: The specimen removed at operation shows a diameter of two to three times that of the normal bladder wall. The surface is intensely red and fissured. Microscopically, an absence of the bladder epithelium is noted and that portion normally lying immediately beneath is very ragged and irregular. At several points is seen a dense wavy line of fibrous tissue which at intervals is missing, being torn off apparently as a result of overdistension of the bladder. The submucosa proper is very vascular and the vessels apparently quite dilated. Throughout the submucosa and in places extending well down into the muscular layers are many small round cells, the infiltration at certain points being quite dense.

Result. The recovery in this case was uneventful. When heard from April 22, 1921, he was free of bladder symptoms.

Case 6. No. 8516. Male, aged fifty-two, seen February 14, 1920, giving a history of urinary frequency for fifteen years. During the fifteen months prior to his admission, his symptoms had become more pronounced and it was necessary for him to void at hourly intervals. When the bladder was allowed to distend, severe suprapubic pain resulted. With these symptoms there had been increasing difficulty in voiding and three days before admission he developed acute retention and had to be catheterized.

On cystoscopy, there was no residual urine and the bladder capacity on forced distension was 150 cc. The bladder urine was perfectly clear and uninfected. In the posterior wall to the right of the midline was found an irregular, more or less linear red area, and behind each ureteral orifice, similar although smaller areas were seen. The remainder of the bladder mucosa was normal in appearance. There was no trabeculation and no trigonal hypertrophy. In view of the history of urinary obstruction and recent retention, notwithstanding the absence of residual urine and trabeculation, the condition was thought to be a contracture of the vesical orifice and a punch operation was carried out. During the following six weeks the bladder was dilated by daily hydraulic distension, the capacity reaching 360 cc.

Cystoscopy April 5, 1920, revealed very little change in the appearance of the inflammatory area, except that possibly the surface lesion was somewhat more pronounced.

During the next eight months there was no difficulty in voiding. The interval between voidings was from two to three hours and the patient experienced practically no pain except at times when the bladder became greatly distended. About January 1, 1921, his bladder symptoms suddenly became much aggravated. There was increasing difficulty in starting the urinary stream and a marked increase in frequency and suprapubic pain.

On cystoscopy January 21, 1921, the bladder capacity was 60 cc. Three superficially ulcerated areas were found in the same positions noted in former cystoscopies.

On January 26, 1921, after overdistension with air, the bladder was opened revealing three bleeding areas back of the trigone. One of these lying quite far posteriorly presented an irregular linear fissure 5 cm. in length which apparently extended into the submucosa. Similar, although somewhat smaller lesions, were seen back of the ureteral orifices. Because of the extensive involvement, resection was not attempted and the areas were thoroughly cauterized. At the end of three weeks the patient was discharged, cystoscopy at this time showing the cauterized areas to be healed and apparently normal except for some edema.

Two weeks later there was a return of frequency and pain, and when seen March 24, 1921, he was voiding every two to three minutes. The urine was clear and not infected. Cystoscopy revealed an irregular, edematous, superficially ulcerated area about 3 cm. in diameter, a short distance back of and to the right of the right ureteral orifice. The

area involved a portion of the bladder formerly the site of one of the smaller lesions previously noted. The posterior bladder wall as well as the region of the left ureteral orifice were normal in appearance.

At operation April 27, 1921, the bladder was first carefully freed from the right side as far as possible posteriorly. It was then opened and a wide, elongated, irregular ulcer, measuring 4 cm. in length by 0.5 cm. in width, was found extending from a point about 1.5 cm. back of the right ureteral orifice on to the right lateral wall. Another ulceration 1 cm. in length was found to the right of this. The bladder wall in this region was greatly thickened, indurated and very adherent to the perivesical tissues. The remainder of the bladder was normal in appearance and the other areas formerly treated with the cautery gave no indication of inflammatory change and the bladder wall at these points seemed to be of normal diameter and consistence. The area of ulceration was excised with a wide margin.

Pathology: The operative specimen which measured 8 by 4 cm. was quite firm and at least three times the normal thickness of the bladder wall. The mucous surface presented several deep, elongated blood stained fissures which extended apparently well into the submucosa. Microscopically, the mucosa was lacking, the superficial surface of the section showing the thin fibrous lamella, torn in many places from the overdistension of the bladder at operation. The submucosa which appeared to be three to four times its normal diameter was diffusely infiltrated with small round cells. This layer showed an increased vascularity with considerable extravasation of blood. The muscle layer showed only here and there a moderate round celled infiltration, but the separate muscle bundles were frequently widely separated, suggesting an edema which probably explained the great increase in the diameter of the specimen.

Result: At cystoscopy on June 18, 1921, the bladder capacity was 80 cc. The posterior and lateral walls were perfectly normal in appearance. On the anterior wall at the point where the bladder was drained was an area of reddening, a not uncommon finding in recently healed suprapubic cases. The patient was voiding at hourly intervals with no suprapubic pain on vesical distension.

Comment: This patient presented in addition to the usual symptoms of this type of contracted bladder others occasionally met with, namely, hesitancy, slow stream and finally complete retention. The obstructive symptoms were at first thought to

have been caused by a contracture of the vesical orifice but a study of the specimens removed with the punch instrument shows only a moderate prostatitis. The obstructive symptoms in this case are thought to have been due to a sphincteric spasm reflexly produced by the very irritable and painful bladder. The case illustrates further the futility of the dilatation treatment as well as the favorable response of two of the lesions to deep cauterization. Whether or not the area finally resected represents a recurrence or the further development of a lesion incompletely destroyed by the cautery is uncertain. The prompt recurrence of symptoms, together with the ultimate pathological findings, rather strengthen the latter possibility.

SUMMARY

The essential lesion in the condition variously described as "elusive ulcer," "localized cystitis," "interstitial cystitis," "panmural cystitis," etc., is a sub-mucous fibrosis. In most cases other evidences of inflammatory change are noted in the different layers of the bladder wall, but these differ in no respect from in the average case of chronic diffuse cystitis.

The cardinal symptoms of the condition are urinary frequency and pain, referred chiefly to the suprapubic region and resulting from overdistension of the bladder.

The diagnosis is based upon the history, the finding of a diminished bladder capacity,with urine not infrequently sterile, the production of intense suprapubic pain when an attempt is to introduce fluid beyond its capacity and cystoscopic findings often comparatively slight and out of all proportion to the clinical picture presented. In cases having sterile urine, cystoscopy may reveal insignificant and trivial areas of reddening of the mucosa at one or more points; in other cases slight puckering is noted, while in cases having an infected urine, superficial ulceration may be present. The occurrence of bleeding at the site of the lesion, following overdistension, is strongly suggestive of the condition, but the production of linear or irregular tears in the mucosa by this procedure is almost pathognomonic of it. The bladder

capacity when the patient is deeply anesthetized, approaches normal, a point of differentiation between the cases in which the lesion is more or less localized and those cases in which practically the entire bladder is involved. In the latter group the bladder is inelastic and the capacity under anesthesia shows very little increase over that when the patient is awake.

Hydraulic distension of the bladder, local application of various drugs, high frequency, etc., have in our experience been unproductive of permanent results in this group of cases.

When the lesion occupies a portion of the bladder permitting resection, this procedure should be employed. In those cases in which resection is not feasible, deep cauterization should be practised.

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PLATE 1

OPERATIVE SPECIMEN SHOWING SUBMUCOUS HEMORRHAGE AND DEEP FISSURES RESULTING FROM OVERDISTENSION OF THE BLADDER

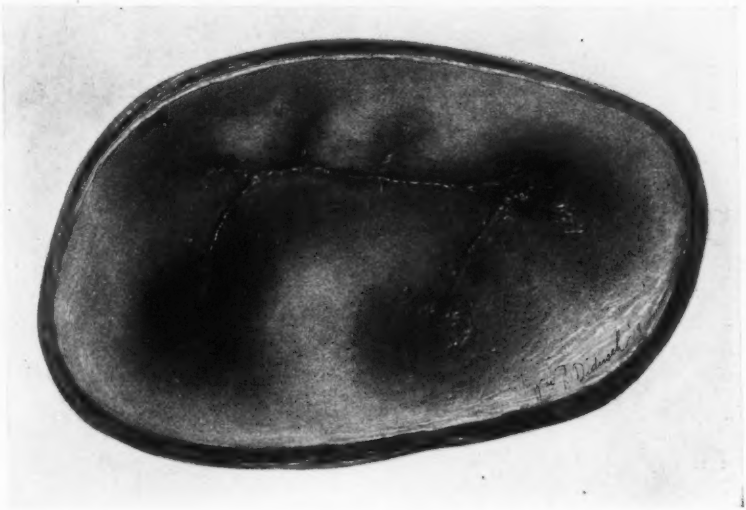
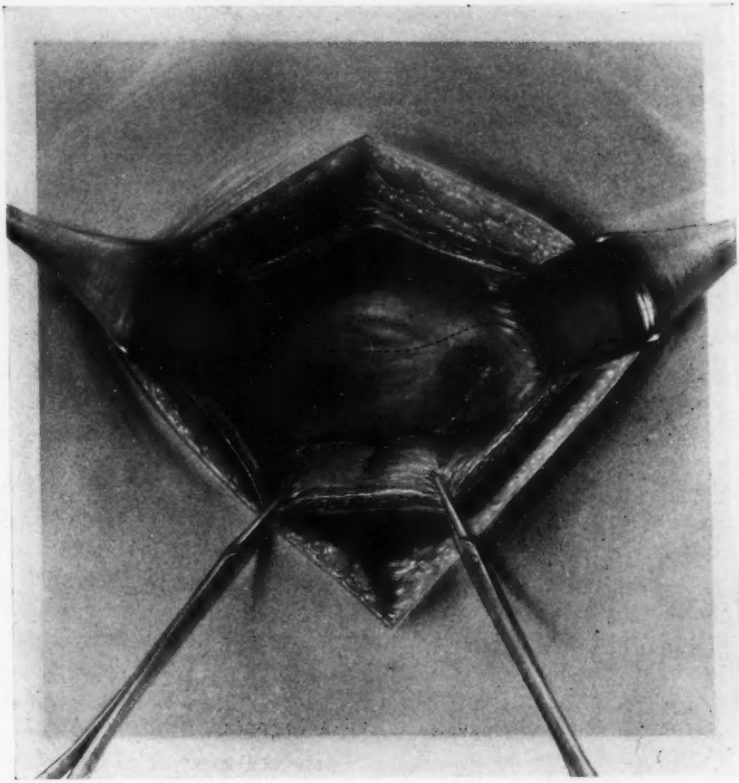


PLATE 2

OPERATIVE VIEW OF LESION SHOWN IN PLATE 1

The dotted line indicates the anterior margin of specimen excised



DISCUSSION

Dr. PEDERSEN: At least some of these patients can be taught to bring pressure to bear on the bladder by means of the abdominal muscles. I have a patient with paralysis of the detrusor, due to a spinal cord lesion, who empties his bladder satisfactorily in that way. Though I believe that his residual urine has increased in the past three years, and though he has a trained man nurse with him, I think it is good judgment not to have a catheter passed for the mere purpose of measuring the residual. The possible risk from back pressure on the kidneys is less in his case than the certain risk of infecting his bladder.

May I ask Dr. Frontz whether syphilis of the bladder is excluded in such cases as he has reported? Many of them have a clinical picture so similar to that of cases of syphilis of the bladder I have seen, that it seems to me necessary to test the question.

Dr. FRONTZ (closing): As regards the final results in these cases of submucous fibrosis, I think the cases which at the time of first examination showed no infection have ultimately gotten better results so far as urinary frequency and freedom from pain are concerned. In some cases the frequency and pain have persisted, although in a diminished degree but in practically all of these cases there has been a coexistent diffuse cystitis. I have not considered the possibility of confusing syphilis with this condition. In none of the cases reported in this series was there anything to suggest that the findings might have a syphilitic origin. Routine Wassermanns, however, were not obtained.

DIVERTICULA OF THE BLADDER

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The advent of the cystoscope has brought out the relative frequency of diverticula of the bladder and has made possible the permanent relief of many sufferers that otherwise would not have been improved. It might seem to one not initiated that it would be perfectly simple with a bladder opened to detect the opening of a diverticulum. On the contrary it would be very easy, even with the inner walls of the bladder before you, to miss the small opening into a large diverticulum. It is easy to see how one doing a two stage prostatectomy might entirely miss the presence of a large diverticulum. We have to depend on the cystoscope and on cystograms to detect this lesion with surety.

A large part of the early work on diverticula was done by Germans. On the other hand it has been for the Americans to perfect the operative technique for its complete relief.

The work of English, Pagenstecher and Wagner stand out particularly in the early work done. The Germans conceived the idea that one could detect whether a diverticulum was congenital or acquired, by examination of the walls of the diverticulum. The congenital ones were supposed to have all the layers of the true bladder wall while the acquired ones had a wall only of fibrous tissue covered with epithelium. The classification has not been borne out by later observers. Thomas in the report of cases in the Mayo Clinic was able to make no such differentiation. I personally have had an opportunity to examine histologically quite a number of diverticula and in none of them have I found the walls of the diverticulum corresponding

to the walls of the true bladder. In the first place the mucous membrane consists usually of a very thin layer of pavement epithelium and in cases where there was much sepsis the epithelium was entirely lacking in many places. The walls were composed mostly of fibrous tissue with only scattered smooth muscle fibers. In no place were definite muscle bundles seen as there are in the true bladder wall.

There has been a great deal of argument pro and con as to whether diverticula are congenital or acquired. Many feel that there is a weakness of the bladder wall that gives way in the face of back pressure. Watson of Buffalo describes a theory for the formation of congenital pouches which may form diverticula. His observations were made on foetal bladders. In the pouches described by him the walls had all the coats of the true bladder. It seems far fetched to me. Why if a diverticulum starts with a wall that corresponds to the bladder wall should it lose this wall. Then too why should not the muscles in the wall of the diverticulum hypertropy and form trabeculations on the wall of a diverticulum.

Thomas finds obstructions to the outflow of urine in 86 per cent of the cases of diverticulum in the Mayo Clinic and concludes from this that obstruction is a causative factor in the formation of the diverticulum. I feel firmly convinced that all diverticula are congenital and that attention is only brought to them by the presence of obstruction or infection or both. Just because obstruction is present does not prove that the obstruction caused the diverticulum. Doubtless where obstruction is present the diverticulum increases in size, but I feel that there must have been a definite sac to start with. The puckered opening into a diverticulum is so distinct and is so different from the small pits or cellulae one so often sees in a much trabeculated bladder that I cannot conceive of one of these pits enlarging and becoming a true diverticulum.

As is well known a diverticulum is inelastic and unable to empty itself so that there is always a puddle of urine left. Infection started from any cause in such a bladder never clears up until the bladder can drain itself. I have lately seen two cases

of double diverticula in young men without obstruction. In both cases the diverticula were found as a result of cystoscopic examination, to find the cause of turbid urine continuing after a gonorrhoeal infection.

There are certain localities in the bladder that are favorite spots for diverticula. The most common spot, as noted first I think by Pagenstecher, is in the lateral walls in close approximation to the ureteric orifices. Another place is in the region of the urachus, though this is not nearly as common as on the lateral walls. It is rare to find diverticula elsewhere in the bladder. It has been suggested that occasionally a pelvic abscess, such as caused by a diverticulitis of the sigmoid might rupture into the bladder with the formation of a diverticulum at the sight of abscess. I saw a case four years ago that I suspected might be of this nature. The opening was high up on the left side of the bladder well away from the ureteric orifice. The patient was a man of forty-five years. He gave a history of having had inflammation of the bowels when twenty. This was followed by passing what he describes as fecal material through the urethra for three months. As this case has never submitted to operation there is no way of verifying this. Pagenstecher also noted that diverticula were very apt to be bilateral and also that they were more prevalent on the left side, and that where they were bilateral the larger one was usually on the left side. In the three cases that I report the diverticula were bilateral, and in all the larger was on the left side.

Cystograms are of importance in making the diagnosis; Lerche in 1911 first makes mention of taking radiographs in various positions in order to get a better idea of the size of the diverticulum. If a diverticulum lies posterior to the bladder you will not get much of it in an antero posterior view, whereas by tipping the patient partly on one side most of the diverticulum will be brought into view. This is well shown in some of the lantern slides that I will show.

Lerche also brought out the ingenious idea of introducing a rubber bag on the end of a ureter catheter and distending the bag with boric solution to determine the size of the diverticulum.

He also used this bag to distend the diverticulum at the time of operation.

Papilloma, cancer, stones and angioma have all been found in reported cases. Von Blum in a recent excellent monograph on diverticula reported a case in which there had been severe bleeding. At operation he found a large angioma in the sac. Thomas mentions the prevalence of pyelonephritis. This, of course, is to be expected. Given an infected urine plus a large residual and the answer is sure to be pyelonephritis in varying degrees.

Hinman suggests the possibility of a diverticulum forcing its way between the rectum and the prostato-vesicle region and thus causing obstruction at the bladder outlet, much the same as an enlarged prostate might do. This sounds reasonable, and it seems to me that retention is much more likely to happen in the presence of acute infection.

The treatment for relief of a diverticulum is of course surgical and complete excision is the only hope of complete relief. The hope of radical cure at times has to be modified by the patient's condition. In 1896 Czerney reported the first radical cure.

Various operations have been devised but the one that has been most successful and the one now in most common use is the extra-peritoneal complete excision through the opened bladder. The transperitoneal route carries with it too much danger of peritonitis as the infection in the bladder in some of these cases is very foul.

Any attempt to enlarge the opening of the diverticulum so that it will drain better accomplishes very little, except perhaps in the case of an hour glass bladder such as Squier reports, which really is different from the ordinary diverticulum. The walls of the diverticulum being inelastic rendered any attempt to make the diverticulum and bladder one cavity of little avail. Drainage of the bladder by a suprapublic tube is often a necessary preliminary step just as it is in prostatectomy, but no hope of permanent relief can be hoped for in this way. Dyas reports a case of a large diverticulum in which he opened the bladder and put a drainage tube through the bladder into the diverticulum

and left it there for ten days. I do not see how he could get more than temporary benefit from the drainage. It seems to me that the only reasonable paliative operation advisable in cases where a complete resection is out of the question on account of the patient's condition or on account of the extreme difficulty in freeing the diverticulum is to remove as much of the fundus of the diverticulum as possible outside of the bladder and then put a drain into the diverticulum outside the bladder. Then from inside the bladder refresh the edges of the opening of the diverticulum into the bladder and sew these edges together. In this way you not only get the drainage of the diverticulum, but there is a chance of obliterating it entirely.

Lower in 1914 described a method of packing the diverticulum with gauze before attempting to free it. Making the diverticulum a semisolid body certainly makes it more easily separated from the surrounding tissues. I have found it of great help.

The method described by Young of using an electric suction pump and everting the diverticulum into the bladder is very ingenious. I have not tried it, but I should think that in some cases the walls of the diverticulum would be so adherent that they would not respond.

The method that I have used is to make an incision from the pubes to the unbilicus down to the bladder, which is filled with solution. The bladder is then mobilized, especially on the lateral walls. After that has beeen done the bladder is opened and the openings of the diverticula made out and explored. Ureter catheters are then passed and left in during the operation, as described by Beer. I have found it a great help to know at all times where the ureter was, as in the cases I have done the ureter lay very close to the sac of the diverticulum. Of course, if the ureter lay very close to the sac of the diverticulum. Of course, if the ureter opens into the diverticulum this cannot be done at first. The diverticulum is then packed with gauze and is freed outside of the bladder by blunt dissection usually with the, fingers. I have found that this works well for the freeing of the fundus of the diverticulum, but that to free the last tissue about the neck of the diverticulum it is easier to remove the gauze and

evert as much as possible of the diverticulum into the bladder and then work with the fingers outside the bladder and the thumb inside the bladder at the outlet of the diverticulum grasping the wall of the diverticulum between the thumb and the forefingers.

CASE 1

In this way the last of the adhesions can be freed. When the diverticulum is entirely freed it is excised at the neck and the cut edges brought together with cromic cargut sutures. The bladder is closed to a suprapublic tube and rubber dam drainage placed outside the bladder to the site of the diverticulum.

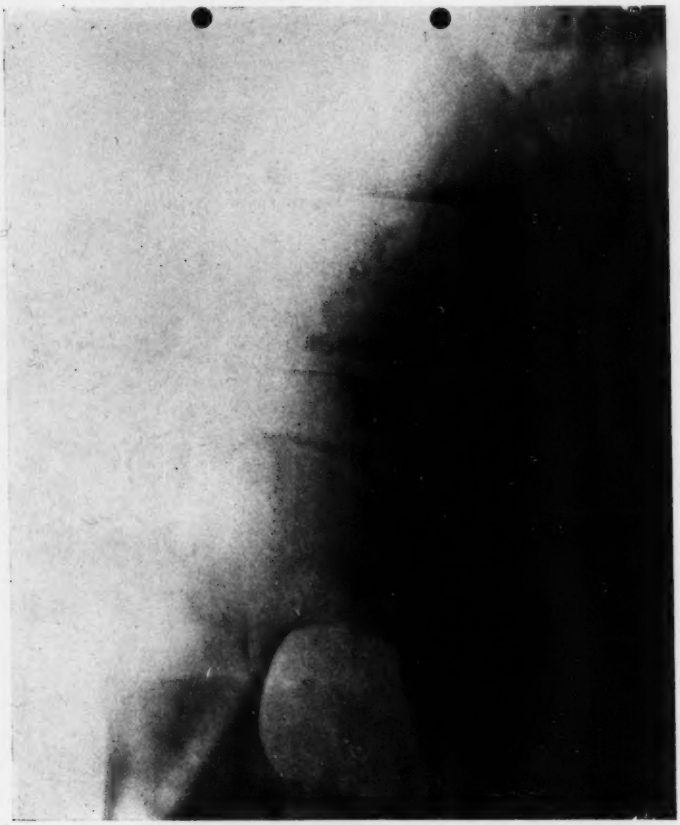
During the past year I have operated on three cases of diverticulum of the bladder that I would like to report briefly. All three cases were double and the openings of the diverticula were similarly placed, in all three. The openings were just above

CASE 1

and slightly to the outside of the ureteric orifice. In all three the larger diverticulum lay on the left side.

Case 1. A man of fifty-one. No urinary trouble until nine years ago when he contracted gonorrhoea. Ever since then he has had an irritable bladder. Two weeks before I saw the patient he began to

have marked increase in frequency and dribbling. His local doctor catheterized him several times and each time found a large amount of urine in the bladder. At the time I saw him he had complete retention. His prostate was not enlarged by rectum. His reflexes were good, and



CASE 1

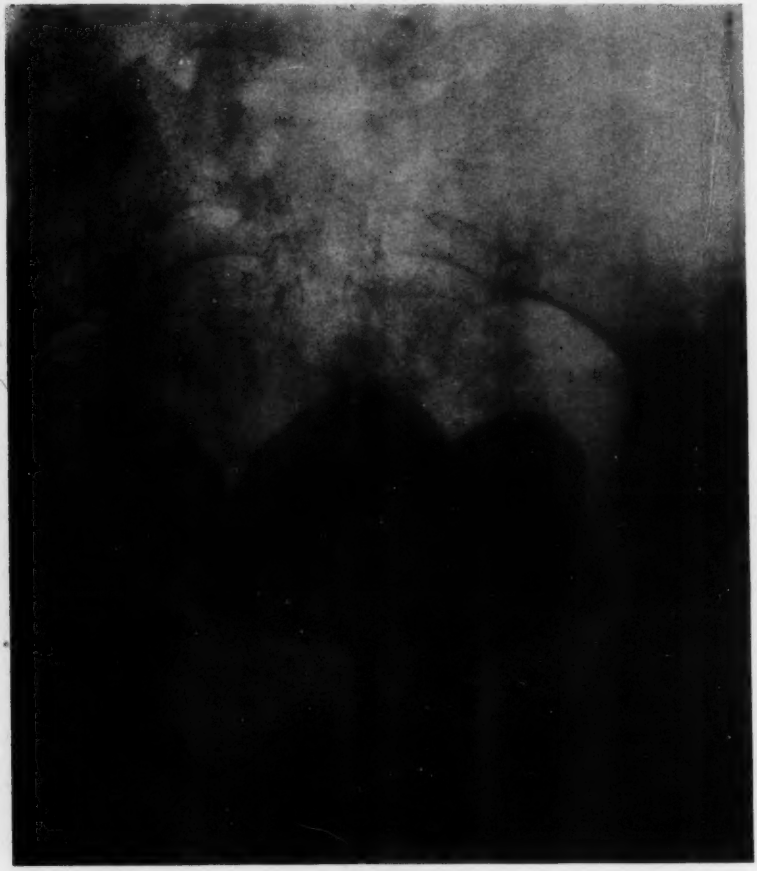
he was in good general condition. On passing a catheter, with no difficulty, 30 ounces of turbid, foul smelling urine was drawn off. I then introduced a cystoscope and at first was at a loss to interpret what I saw. The cystoscope was in a large cavity with smooth glisten-

ing walls that in no way looked like bladder mucosa. I was unable to find either ureter. On the floor of the cavity, some stuck to the walls, were several small stones. On withdrawing the cystoscope to look at the bladder outlet the cystoscope suddenly passed into another cavity

CASE 2

which proved to be the bladder. The cystoscope had at first been in the left diverticulum. An opening of another diverticulum was then seen just above and outside the right ureter. The cystograms taken show the relative size of the diverticula. After a week's drainage by

catheter I operated on him and removed both diverticula. The one on the left was very large and adherent to the rectum. There was considerable bleeding. The bladder outlet, it was noted, was very tight.



CASE 3

This was dilated, but it did not seem wise to attempt anything radical at this time. After the bladder had healed this man still had a residual of 9 ounces. I then removed a small fibrous prostate by the

perineal route and he was able to empty his bladder completely. I feel sure that in this case the infection in the diverticula had some effect in producing his complete retention.

CASE 3

Case 2. A young man of twenty-four who had never had urinary trouble until three years ago when he had gonorrhoea. He has been troubled with frequency ever since. He has constantly been under treatment for chronic gonorrhoea on account of the urine remaining turbid and containing a large amount of pus. He had had a complete

course of sounds and massage. At no time was there evidence of stricture. Cystoscopic examination showed a residual of 4 ounces of turbid urine. The whole bladder mucosa was injected. The diverticula openings were seen, one just above and outside each ureteric orifice.

CASE 3. LARGE DIVERTICULUM ON LEFT

The cystograms show the relative size of the diverticula. The larger one on the left. These diverticula were resected. At the end of two months the urine was clear and there was no residual.

The third case was in a woman of fifty-five who had had a bladder stone removed through the vagina seven years before. She has been

troubled with frequency ever since. One week before I saw her she had acute retention and had to be catheterized since. Cytsoscopic examination showed considerable cystitis. Just above and to the outside of each ureteric orifice was the opening of a diverticulum. The urine was turbid and contained a large amount of pus. Cystograms showed two diverticula, the larger on the left. After a week of catheter drainage both diverticula were resected. The patient is now free from symptoms and empties her bladder completely.

Cases two and three undoubtedly had had the diverticula always but they had had no symptoms until infection called attention to it. In case one there was obstruction to the outflow of urine, but I doubt very much if it had anything to do with the formation of the diverticula.

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A CASE OF PROSTATIC INFECTION COMPLICATED BY OSTEOMYELITIS

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To make the report as concise as possible, I have reduced it to the points that characterize the case.

A sudden onset of acute frequency, urgency and moderate tenesmus in an able-bodied, vigorous-looking man fifty-eight years old, of good habits and more than average good health, without urethritis—past nor present.

A history of colitis some years before; a degree of asthenia from weeks of over-work and absence of exercise; recent constipation and a confessed absurdly gross error in diet, the consequences of which furnished a prodromal period of about twenty-four hours.

The ease with which light, digital massage of the prostate expressed free, blood-tinged pus from the meatus on the second and third days of the attack, after which period pus was not obtained, though the left lobe of the prostate became moderately swollen, remained stationary a few days without signs of fluctuation, then resolved.

A temperature that ranged from 101°F. to 102°F.; no chills; some sweating.

Hyper-acid urine; 1025; many red blood cells and a large number of pus cells with consequent heavy traces of albumen; no casts; a marked indican reaction and faint traces of acetone. The colon bacillus absent; the staphylococcus present.

Gradual, uninterrupted subsidence of the bladder symptoms to normal in two weeks. Clear urine, free from albumen.

No direct treatment of the bladder nor urethra. The infection being autogenetic, the possibly aggravating effect of instrumentation was avoided. The treatment was purposely limited to digital massage and rectal irrigations. Colonic irrigations with a 3 per cent anhydrous sodium carbonate solution were added, in deference to the acetonuria. This incidental feature soon became marked, but was quickly controlled.

The affected joint was the left elbow. Following a slight traumatism only two days after the first prostatic symptoms, there developed with fair rapidity, a very slightly painful fusiform swelling, lightly mottled with redness over the inner aspect, and tenderness over the condyles.

The roentgenogram, made on the sixth day after the traumatism, showed "a very slight lipping about the tip of the olecranon."

The blood Wasserman was negative, the chemistry, just within the upper normal limit; the leucocytes numbered 16,000; the polymorphonuclears 89 per cent; a culture was not made.

The prostatic symptoms (objective and subjective) ran a brief course as already noted; the clinical course of the complicating elbow joint, however, was typically chronic. Partial immobilization, the salicylates, and baking had little obvious positive effect. Measurable improvement began with the addition of potassium iodide, and enabled the patient to return to his office.

The roentgenogram made at this stage showed a surprisingly extensive lesion of the lower end of the humerus; a general surgeon who saw the patient in consultation at this time, thought radical intervention imperative. An intramuscular injection of bi-chloride, however,was followed so promptly by a diminution of the swelling and tenderness that within 48 hours, he reversed his opinion.

The injection of $\frac{1}{4}$ grain was continued every other day for one month; less frequently for the second month; then discontinued. The baking was continued a while longer. Exercise of the joint (passive and active) was later encouraged.

The results were followed up by roentgenograms at regular intervals. The areas of rarefaction gradually filled up, and the function of the joint became normal, a slight limitation to extension excepted.

The seemingly direct response to the injection of bichloride is of interest, I believe. The question is, did the bichloride cause the effect, or had the pathological process in the lower end of the humerus run its course and had repair already begun?

A second question is, should the left lobe of the prostate have been incised though no fluctuation had appeared?

On the other hand, I think there can be no question as to the advantage of having withheld all instrumentation of the bladder and urethra.

VAGINO-VESICAL AND UTERO-VESICAL FISTULAE

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Royal Victoria Hospital, Montreal

Urinary fistulae bring about a condition which makes the patient truly miserable and becomes a source of great worry to all thinking genito-urinary surgeons. It may be due to extrophy of the bladder, to transplantation of ureters in the skin, to traumatic sinus from the ureter to the vagina or to traumatic utero-vesical, vagino-vesical or urethro-vaginal openings.

This paper will deal with what we consider a few important points in the operative treatment of utero-vesical, vagino-vesical, and urethro-vaginal fistulae by the perineal route. We do not claim originality in any way. We will simply describe in detail the methods employed on our service for the closing of the fistulae between the bladder and the vagina or the cervix or both. Such fistulae are the result of difficult parturition, colpotomy wounds, abdominal operations and more particularly hysterectomy, radium or cautery treatment for cancer.

In general obstetric management and operative treatment have both greatly improved in later years but from the records in the majority of the large clinics in America and in Europe there is abundant evidence that we still have such fistulae to combat. During the past three years in our own clinic we have had from almost every section of the United States and Canada patients suffering from this condition; and that the technique still calls for some further details is proved by the histories of from one to eighteen operations on the same patient. In a long series from the Mayo Clinic, Judd reports patients who had six and seven previous operations. One of our patients with a high vesico-vaginal fistula had undergone seven operations,

another twelve operations. One woman with complete loss of the floor of the bladder from cervix to urethra inclusive, had eighteen operations before coming to our service.

That the best method of operation is still undecided is deduced from the arguments of many prominent surgeons. Trendelenburg, Marcy, Legueu and others claim advantages for the transperitoneal route; Paris, Francey and others from the transvesical route; Schulze-Berge advocates operation through the pre-vesical space; Bachrach, upholds the transplantation of the ureters in the skin. Several surgeons believe in the transplantation of the ureters in the bowel; Nighoff and Mayo argue the superiority of the purse-string suture with traction to the bladder; Latzko, Rosenski, Bertino, Ferroni, MacLean, Ward, Judd and Kelly support many different varieties of the vaginal route. For suture material some use silk, some catgut, some silk worm gut and some silver wire.

The suprapubic operation is as a general rule more suitable for uretero-vaginal fistulae but even at its best, for vesico-vaginal and vesico-cervical, it is more severe and it has a much higher mortality than when these conditions are approached from below. To Trendelenburg is due the credit for first using the suprapubic operation for the cure of these fistulae. His work was published in 1890. In 1902, Kelly advocated the employment of the knee-chest posture in order to obtain a good exposure of the vaginal vault. He opened the peritoneal cavity by a wide transverse incision. Eleven years later he contended that the lithotomy position was superior to the knee-chest posture.

The method to be employed in each case must of course be determined by a careful consideration of the conditions present and by the experience of the operating surgeon. In some cases, mainly those associated with the ureter, the suprapubic is the only choice, but in all others the vaginal route should be tried first.

The apparent ease with which these fistulae may be closed is too often very deceiving to the inexperienced and unless definite procedures are followed, the results are often very unsatisfactory.

Before any operative procedure is undertaken the ureteral

openings and the opening of the fistula in the bladder should be definitely located. If the opening is very small and free of the ureters, the high-frequency current may be tried. All possible facts regarding the course and position of the sinus should be ascertained before treatment is considered. An effort should also be made to get the tissues in the best possible condition for healing; this latter often requires considerable time as the mucous membrane of the vagina, bladder and labia may be much excoriated, infected, and coated with deposits of urinary salts.

One of the greatest difficulties encountered is trauma to the vesical neck with partial or complete loss of the vesical sphincter. If the opening of the bladder is high in the vaginal fornix, and especially if there is much scar tissue, it is sometimes difficult to obtain sufficient exposure for satisfactory dissection. This consideration led us to make two free lateral incisions in the perineum, lateral episiotomy wounds, with the same objective as Ward had with his paravaginal incision. It is surprising to what extent this will facilitate the bringing of the cervix and the fornix in full exposure in the operative field. With catheters in the ureters and a catheter through the fistula from the bladder to the vagina, as guides, it is much safer to proceed with the dissecting of the vaginal from the bladder wall. Grasping the cervix with a tenaculum, we have used a long incision, antro-posteriorly, in the vaginal vault surrounding the sinus. The vagina is now freely dissected from the bladder wall until the bladder hangs loosely and can be easily invaginated into that viscus. Unless this dissection is throughly carried out the possibility of cure is remote. With a small curved needle and a moderately fine catgut the sinus is invaginated into the bladder with interrupted sutures or, if the fistula is small, with a purse-string suture. These are further reinforced by one or more lines of Lembert sutures. The vaginal wall is then loosely sutured over this with fine catgut. If the sinus is in the sulcus at the cervix, the denuded cervix may be used to make body for our suture; if the urethra has been torn, it is well to dissect free both the sides, and, if possible to grasp some of the sphincter fibers or the scar tissue to which these are attached and to suture one side to the other to get a central body to give control. It

is obvious that the bladder flaps should be free and loose and easily approximated in order that no tension may be exerted on the suture. We have used plain catgut entirely in these cases.

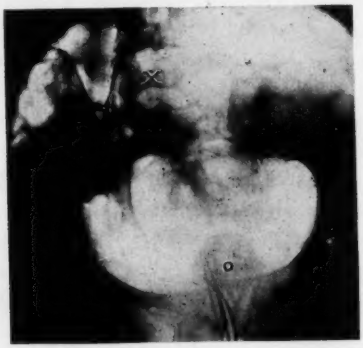

FIG. 1. CASE 11

Illustrating utero-vesical fistula with catheter in it and complete curve of right ureteral catheter. 1, Loop of ureter functionating; 2, catheter in sinus.

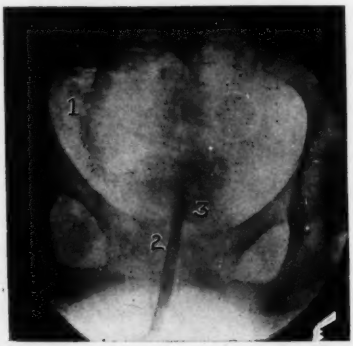

FIG. 2. CASE 4

Illustrating irregular cystogram with dilated ureter and sinus to vagina following appendicectomy. 1, Sinus; 2, catheter, 3, dilated remaining ureter; 4, irregular bladder.

We believe that the sloughing of the flaps or about the wound is too often due to tension on the sutures. The lateral perineal incisions are now sutured and the vagina is carefully packed with iodoform gauze to obliterate any dead space between the vagina

and the bladder wall and also to elevate the floor of the bladder in order to bring the line of suture, if possible, to the ridge of a watershed.

The post-operative care is most important. A little carelessness at this point may destroy all hopes of final success. Following the operation, we have emptied the bladder, by means of a retention catheter or frequent catheterization. One of our patients urinated spontaneously after the second day without any undesired effect. All our patients were kept in bed for a period of from two weeks to eighteen days after operation. There is no mortality in the series and the results were according to the table.

TABLE 1

Type of urinary fistulae operated on from November, 1917, to November, 1920

Complete laceration from cervix through urethra	2
Vesico-vaginal	3
Vesico-cervical	2
Uretero-vaginal	2
Vesico-urethro-vaginal (multiple openings)	1
Urethro-vaginal	2
Recto-vesical vaginal	1
Total	13
Age of youngest patient	16 years
Age of oldest patient:	
Vesico-vaginal	51 years
Uretero-vaginal	63 years

TABLE 2

Extent of involvement

Complete from cervix through urethra	2
Multiple sinus with absolute loss of urethra	1
Partial loss of bladder sphincter (no control)	2
Single sinus (vesico-vaginal and vesico-cervical)	5
Single sinus (uretero-vaginal)	2
Secto-vesico-vaginal	1

TABLE 3

Etiology

Childbirth—Spontaneous	1
Instrumental	6
Appendicectomy	1
Colpotomy	1
Hysterectomy	3

TABLE 4

Operations elsewhere

3 patients	1 operation
1 patient	18 operations
1 patient	7 operations
1 patient	12 operations

TABLE 5

Patients operated on in our service

9 patients	1 operation
3 patients	2 operations

TABLE 6

Results

Vesico-vaginal	Cured 3
Complete laceration cervix through urethra	Cured 2
Vesico-cervical	Cured 1
Vesico-cervical	Improved 1
Vesico-urethro-vaginal	
Two attempts for control (slight leakage on walking)	Improved 1
Urethro-vaginal	Cured 2
Recto-vesico-vaginal	Not treated

Case 1. L. S. Age fifty-one; married.

Admitted: September 17, 1917.

Discharged: October 23, 1917.

Came complaining of leakage of urine through vagina for three years following operation by vagina for a pelvic abscess. Had 7 previous operations.

Cystoscopy: Showed a large sinus just internal to right ureteral orifice. Ureteral catheter easily passes through this into vagina. Vaginal examination shows a dimple with much scar tissue about it just to right of cervix in vault of vagina.

Operation: Catheters in position. Liberating lateral perineal incisions. Longitudinal incision in vaginal wall extending down to right of cervix. Enclosing sinus. Vaginal wall well freed from bladder wall and closed with interrupted sutures, reinforced with two layers of Lembert-catgut No. 1. Lateral perineal incisions also closed with catgut suture.

Result: Cured. Out of hospital twenty-five days after operation.

Case 2. E. S. Age forty-two; married.

Admitted: October 28, 1917.

Discharged: December 4, 1917.

Complaints: Urinary leakage through vagina for three years. Had 12 operations for relief.

Cystoscopy: External genitals of urethra irritated. Bladder small content. Right ureteral orifice normal. Left ureteral orifice is just below a large opening to the vagina, in scar surrounding this fistula.

FIG. 3. CASE 1
Vesico-vaginal fistula high

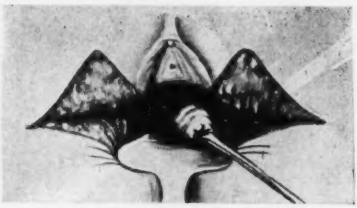

FIG. 4. CASE 1

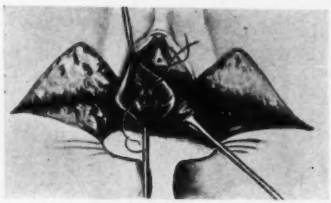

FIG. 5. CASE 1

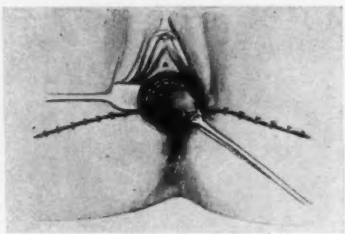

FIG. 6. CASE 1

Unable to pass catheter up left ureter. Catheter through fistula passes into vagina at vault on the left just below line of suture of old hysterectomy wound.

Urinalysis: Turbid, acid, 1026, albumin a trace, sugar 0. Micros. pus ++, bacilli

Operation (plastic): Lateral vaginal incisions. Dense scar about vagina openings. Vaginal mucosa freed from bladder. Sinus wall invaginated into bladder. Vaginal wall sutured over this. Rest as usual.

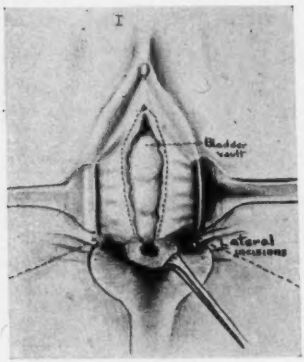

FIG. 7. CASE 3
Extensive laceration

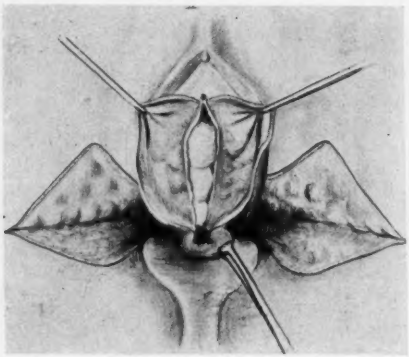

FIG. 8. CASE 3

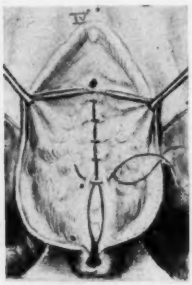

FIG. 9. CASE 3

FIG. 10. CASE 3

Case 3. J. S. Age sixteen; single.
Admitted: December 29, 1919.
Discharged: February 14, 1920.
Complaints: Incontinence of urine for six weeks following instrumental delivery.

Genito-urinary system: Linear slit easily admitting 3 fingers and extends from cervix uteri to urethra. Vault of bladder prolapses through opening.

Operation: Liberating incisions and dissection. Vagina freed—interrupted Lembert sutures, several layers over each other.

Result: Complete recovery.

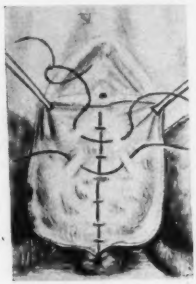

FIG. 11. CASE 3

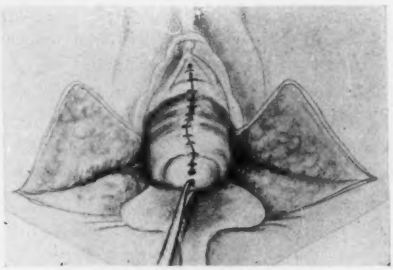

FIG. 12. CASE 3

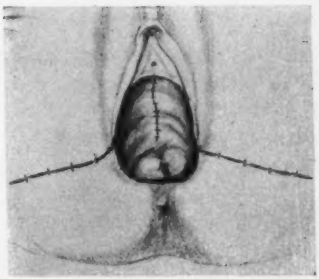

FIG. 13. CASE 3

Case 4. B. G. Age thirty-two; single.

Admitted: July 3, 1919.

Complaints: Incontinence: June, 1908. Appendix removed. July, 1908. Search for sponge—no sponge found. April, 1909. Right kidney removed. Incontinence followed.

Findings: Urethra normal—excellent control.

Cystoscopy: Bands of adhesions separating bladder into two cavities. Small sinus to right leading to vagina to right and anterior of cervix.

Diverticulum of bladder (catheter coiled) probably traumatic. See diagrams.

First operation: Lithotomy: catheter in left ureter; probe through sinus liberating incisions. Incision: Vaginal wall freed from bladder and separated. Sutured. Vaginal packing. Slight leakage from tenth day. Three months later second similar operation successful.

Result: Cured.

Case 5. M. K. Age thirty-five; married.

Admitted: August 9, 1920.

Discharged: September 5, 1920.

Complaints: Incontinence of urine, following severe instrumental labor for ten weeks. Has had 5 full term labors with 3 instrumental deliveries. Vaginal examination shows extensive old laceration cervix especially on left.

Cystoscopy: Instrument easily introduced. Ureteral orifices: Left normal in contour and position. Right normal in contour, drawn upwards. Scar, in center of which is a fistula one-half an inch from ureteral orifice. Catheter in fistula comes through cervix into vagina.

Urine: Pale, cloudy, acid, 1012, albumin and sugar 0. Micros. pus +, epithelium, bacteria.

Phenolsulphonephthalein test: first hour 21 per cent, second hour 12 per cent, total 33 per cent.

Culture of bladder urine shows B. coli-communis.

August 16, operation for utero-vesical fistula.

Result: Cured, discharged twenty days after operation.

Case 6. M. G. Age thirty; married.

Admitted: September 1, 1920.

Complaints: Constant dribbling of urine from vagina for three years, following instrumental delivery—severe laceration. Eighteen operative attempts unsuccessful. Funnel pelvis.

Cystoscopy: No evidence of a urethra; instead to patient's left is a gaping opening—will admit index finger. About $1\frac{1}{2}$ inches posterior to this in left of vagina is another large opening admitting index finger to bladder. Right ureteral orifice slightly external to posterior opening. Left orifice $\frac{1}{4}$ inch above and included in the scar tissue about opening. See diagrams.

Operation (plastic). Successful in closing sinuses but control lacking when walking. See diagrams.

Case 8. E. C. Age thirty-seven; widow.
Admitted: February 24, 1919.
Discharged: March 30, 1919.

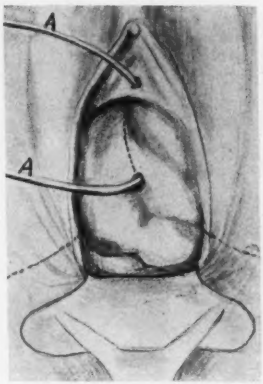

FIG. 14. CASE 5
Utero-vesical fistula. *A*. Catheter through urethra and sinus

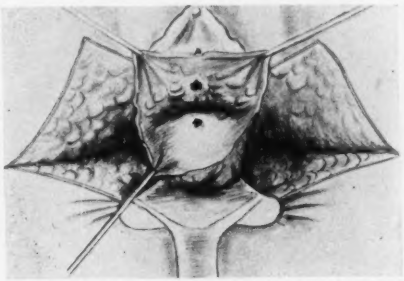

FIG. 15. CASE 5

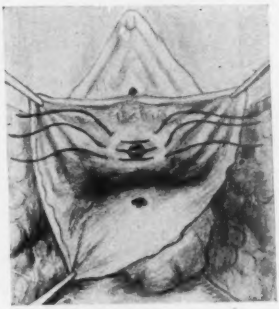

FIG. 16. CASE 5

Complaints: Inability to retain urine for one year.

Symptoms: Lacks control of urine when walking, coughing and sneezing. Frequency of urination. Urgency. August, 1918, perineal repair—symptoms relieved for two months. Five children, no instrumental deliveries.

Cystoscopy: Marked cystocele. Scarred gaping urethra. Otherwise normal.

FIG. 17. CASE 5

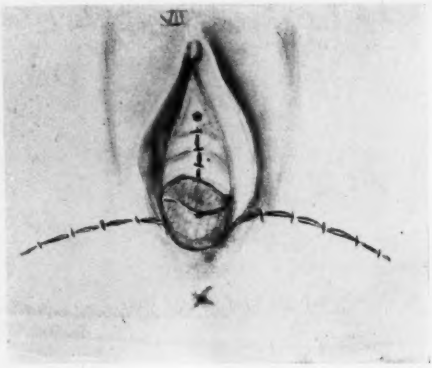

FIG. 18. CASE 5

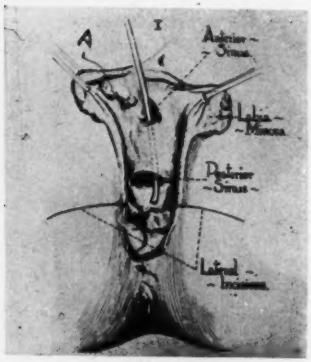

FIG. 19. CASE 6
Multiple fistula with absolute loss of urethra

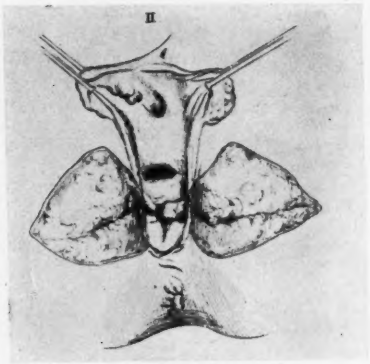

FIG. 20. CASE 6

Operation: Vertical incision from just behind meatus for 4 inches. Vaginal wall separated from floor of bladder for 3 inches. Lembert sutures. Vaginal packing.

Result: Cured.

Case 9. J. McM. Age forty-one; married.
Admitted: August 2, 1918.
Discharged: August 6, 1918.

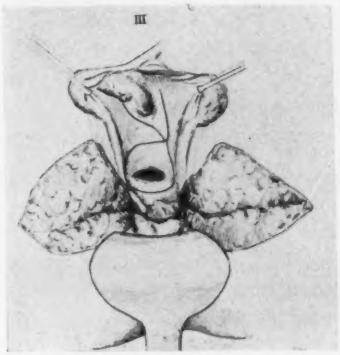

FIG. 21. CASE 6

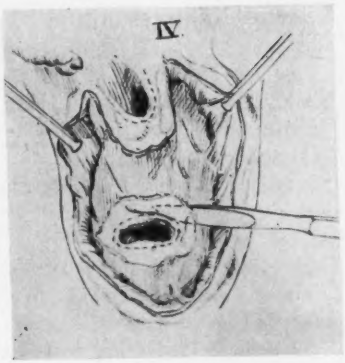

FIG. 22. CASE 6

FIG. 23. CASE 6

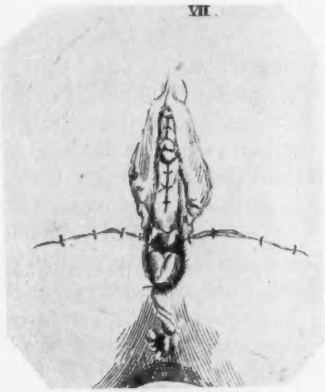

FIG. 24. CASE 6

Complaints: Frequency of urination. Blood and faeces in urine.
Onset: May, 1918.
Symptoms: Operation March, 1918, for ovarian trouble. May, 1918, frequency with faeces in urine.

Cystoscopy: Malignant growth right side of bladder from base to vault. In center of ulceration, slightly more to patient's left is a sinus through which faeces passes. Recto-vesical fistulae. Carcinoma of bladder, vagina and rectum.

Result: Nil, no treatment.

Case 10. M. E. S. Married.

Admitted: February 18, 1919.

Discharged: March 18, 1919.

Complaints: Leakage of urine into vagina for eight months.

Symptoms: Following forceps delivery urine came away through vagina. Operation November 1918—no result. Has had 8 children—last one by forceps.

Cystoscopy: Perineal laceration. Rectocele. Vesico-vaginal fistula admits 2 fingers; extends from cervix uteri into urethra and towards patient's right. Roof of bladder prolapses through.

Operation: Liberating incisions. Difficult separation vaginal wall from vesical. Much scar. Bladder and urethra closed by Lembert. Closure as usual.

Result: Cured.

Case 11 E. M. Age thirty-five; married.

Admitted: February 14, 1918.

Complaints: Inability to hold urine for five years.

Symptoms: Incontinence of urine immediately following instrumental delivery. Later hysterectomy. Constant dribbling of urine. One previous operation unsuccessful.

Cystoscopy: Bladder much contracted. Floor pulled upwards. Large opening upper portion of floor of bladder to left of left ureteral orifice which is in scar of fistulae.

Vaginal end of fistulae in cervix uteri.

Operation: Liberating incisions. Sinus in dense scar high up. Carefully freed—good flap to right. Poor to left. Lembert sutures. Closure as usual.

Result: Improved.

In conclusion, I wish to emphasize a few points considered of vital importance. These are:

1. Pre-operative cleansing of the parts.
2. Attacking the condition from a urological point of view.

3. Definite diagnosis with location of openings in the bladder and the relation to the ureteral orifices.
4. Lateral perineal incisions, especially for fistulae high in the vagina or uterus.
5. Free separation of the vaginal from the vesical wall.
6. Multiple layers of suture with invagination of the bladder into that viscus.
7. Vaginal packing to elevate and support the suture line.
8. Post-operative judgment and care.

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DISCUSSION

Dr. A. L. CHUTE: I have been much interested in Dr. MacKenzie's paper. In this connection I should like to speak again of the advantage of having a patient, who has been operated upon for vesico-vaginal fistula, by whatever method, lie upon her abdomen for some days following operation. This takes the weight of the urine in the bladder off of the line of suture. Besides taking this position I have these patients wear a retention catheter. This maneuver, which I believe is of considerable value in the after-care of these cases, I brought to the attention of the Society at our meeting last year.

Dr. CUNNINGHAM: I cannot refrain from adding a word of appreciation of the operation which Dr. MacKenzie has presented. I was impressed with his method of attacking this most distressing condition when it was brought to my attention in Montreal last fall, but even his brilliant result did not entirely dissipate my skepticism in regard to obtaining a cure by a single operation. Since that time I have operated upon but one vesico-vagino fistula which was of considerable size and of long standing with a result just as satisfactory as could be hoped for and far more satisfactory than one usually gets by any other method with which I am familiar. In fact, one operation cured the condition. I heartily indorse everything that Dr. MacKenzie has said.

SOME ASPECTS OF CANCER OF THE PROSTATE

ARTHUR L. CHUTE

In going over the last 200 cases upon whom I have done a prostatectomy I have found that in 35 of these cases or 17.5 per cent of the whole, the prostate was malignant. I have taken these 200 cases as they seemed to fall rather naturally into a group by themselves, likewise because of the fact that during this time neither my techquenic nor my views regarding the indications for operation have changed materially.

While in this group of 200 cases I have recognized 17.5 per cent as malignant, I think it is more than probable that this figure underestimates the relative frequency of cancer of the prostate since some of the beginning cases show very little that is particularly suggestive of the condition, especially those in which the disease is associated with hypertrophy. I think it is more than likely that I have overlooked some cases in this series and that the actual incidence of malignancy may have been somewhat higher than 17.5 per cent. As these operations were carried out upon both hospital and private patients, taken in order, I believe the figures represent pretty well the relative frequency with which we may expect to find malignant disease in any considerable series of cases of prostatic obstruction. These figures practically agree with other series that have been reported, in which malignant diseases has been recognized in about 20 per cent of the cases.

Although these malignant cases constitute, according to my figures, a very considerable proportion, about one-sixth of the total of cases of prostatic obstruction, it is my experience that there is a great divergence of opinion among genito-urinary surgeons, concerning the indications for operation in these cases and also little agreement as to what sort of an operation it is wise to carry out in the cases where operation is indicated. I can perhaps best illustrate this attitude by certain incidents that have come

under my notice, some of them within a relatively short time. For instance, a little more than two years ago I operated upon a man eighty-two years old with an extensive cancer of the prostate as felt by rectum; this man had an over-distended bladder, nearly up to his umbilicus. A man whose opinion I value highly had advised against any attempt at operation though catheterization was most difficult, the idea being, as I understook it, that operation would probably not be worth while. This man's bladder was, however, drained as a preliminary step and then under spinal anaesthesia as much of the malignant disease as I could get was removed through a perineal incision. This patient, who is alive twenty-six months after operation, was relieved of his retention and has attended to his business a considerable part of the time since operation. A rectal examination of this man's prostate made quite recently showed the sharp angular edges where the malignant tissues had been cut at the time of operation; this angularity existing two years after operation seemed to me to indicate the relatively slow progress of the disease locally. This patient has, however, had some increase in his obstruction of late but still has little in the way of cachexia. I feel that the palliation he has had has been well worth while, and I even stand ready to advise the re-removal of his growth if his obstruction to urination increases much. This re-removal of a malignant prostate is a point to which I shall refer later.

Again, last summer I removed by the perineal route as much as I could get of a malignant prostate that had been particlly removed by the suprapubic route about a year before. This operation had been done by a man whose opinion and work I greatly respect, but who felt that further operation was in this instance useless and would do harm rather than good. I did the second operation because of a recurrence of the obstruction attended with more or less bleeding. The patient has been much more comfortable than he was; had practically no residual when I last saw him; has attended to his business, and has made a certain number of business trips. He has also been able to play golf with reasonable ease. This case can hardly be spoken of as a second removal of a cancerous prostate since the area from which I removed the malig-

nant disease was probably below that reached in the first operation. Two other instances have come under my notice within the last few weeks where men with a considerable experience, when unexpectedly confronted at operation with a carcinomatous prostate practically made no attempt at its removal.

I can readily understand this attitude regarding the operative treatment of cancer of the prostate though I do not sympathize with it. It is I believe the very natural result of the contrast between the wonderful results obtained by the removal of the benign prostate and the relatively disappointing results obtained by the removal of malignant prostates. When one compares the results obtained in the treatment of these two classes of disease, there is little wonder that the cancerous cases seem hardly worth doing from the standpoint of cure. Cure is, however, not possible in all conditions; in some we must be content with palliation and a semi-occasional cure, and if in many cases of disease that is necessarily fatal eventually, we can prolong life for a year or two and especially if we can add to the patient's comfort, I believe it is well worth while. When looked at from this point of view the subject I believe assumes a different aspect.

It has been my exprience to encounter cancer of the prostate under three conditions: first, in cases where it has produced symptoms because of the obstruction it has offered to urination; second, where it has produced pain due to pressure, and finally where in relatively young men it has produced vague urinary symptoms that have led to an examination of the prostate and its discovery, accidentally so to speak.

It is my belief that when a carcinoma of the prostate is causing any particular obstruction to urination we should remove as much of it as it is possible for us to do, just as we would in the case of a non-malignant prostate causing obstruction: That while we cannot hope to cure the condition except in the rarest instances, we can, in many cases, give degree of palliation that is well worth while and in fact actually lengthens life, for in a very considerable proportion of unoperated cases of cancer of the prostate, the patient does not die of the cachexia of his carcinoma but the fatal result is in a large measure due to the same pyelonephritis that we see in other instances of urinary obstruction.

I have not infrequently had men object to the removal of a carcinomatuous prostate that was producing obstruction to urination, on the ground that the inguinal glands were involved of course, when one considers the operation from the point of view of palliation the presence of inguinal glands even if known to be malignant, is not a bar to operation. Another objection has been the fear that the incision could not be made to heal, a groundless fear, I believe, when the proper technique is employed.

In those instances of cancer of the prostate where the patient's greatest compaint is of pain either in the region of the sacrum or in the thighs, the indications for operation are less clear than in the cases that produce obstruction to urination. In some of these patients, however, the removal of such malignant tissue as we can get is followed by an amelioration of the pain. I am inclined to believe that we are justified in cases of this sort in removing as much of the malignant tissue as we can get especially if at the same time we implant radium in the walls of the cavity. No operation would be indicated in cases where it seemed probable that the pain in the legs was the result of a metastatic involvement of the spine. In my own cases of this type the pain has apparently been due to a lateral extension of the disease and the consequent pressure.

In the third group of cases, those in which one comes upon cancer of the prostate accidentally so to speak, where it is not producing either urinary obstruction or referred pain but just a feeling of discomfort such as is occasionally found with chronic prostatitis; in these cases the indication as to what course we should follow is far from clear. In general we know that the course of the disease, if unchecked, is fatal though it may often be slow; that the removal of the tissue may be attended with a long respite and possibly in the very rarest instances by cure; also that the use of radium, the application of which operation greatly facilitates, inhibits the disease in most instances and probably actually cures it in some. All these would argue for operative interference in these cases. On the other hand it has been my experience that some of these cases, of which I am glad to say I have only seen a few, have not done well following operation but have gone on rapidly to a fatal termination.

In the removal of the malignant prostate there are three procedures that I have found useful. I have not made use of the radical operation devised by Young for the reason that I have found few cases to which I thought it was applicable. To use it I have felt one must be sure that there was no metastasis: That it was too radical to use unless you could practically be sure that there was no extension of the disease and that you could remove it all.

In a small proportion of these cases one may remove a malignant prostate by suprapubic enucleation. This is possible, however, only in the less advanced cases where the growth is pretty well within the capsule. In a considerable proportion of the instances where I have removed a malignant prostate by the suprapublic route I have failed to recognize the types of disease with which I was dealing until the time of operation, it has been, in fact, the difficulty of enucleation that has first called my attention to its nature. In this series of 35 patients I operated on seven cases by the suprapublic route. All these patients had had a preliminary suprapubic drainage on account of their poor condition. In five of these cases I had not recognized that the condition was malignant before the time of operation. In two the condition had been recognized as malignant previous to operation but as it has seemed best to do a preliminary drainage on these patients it seemed wisest to attempt the enucleation through the suprapubic incision.

In instances where a preliminary suprapubic drainage has been carried out and yet in which the prostate is so dense and firmly attached that it cannot be enucleted from above, I have been accustomed to make use of a combined method. This I employed in six of the patients in this series. In this procedure one makes the usual perineal incision and cuts and bites out all the malignant tissue that he can get. Much more accurate use of the prostatic punch may be made in this way, since it can be introduced through the perineal wound but used under the guidance of the forefinger, introduced through the suprapubic wound. The perineal wound facilitates the application of radium and the suprapubic opening offers a splendid change to control hemorrhage by packing, should that be necessary. A previous suprapubic incision in no way

complicates the perineal removal of a cancerous prostate or benign one for that matter, if anything, it facilitates it.

While the two methods just mentioned are applicable to the removal of a certain number of cancers of the prostate, the method which has the greatest applicability is a slight modification of the Young perineal operation for the adenomatous obstructing prostate. I employ the classical position, incision and dissection of the perineum until I reach the prostate. I then, however, make a transverse incision into the prostatic tissue, which I find better adapted to the purpose than the antero-posterior incisions usually employed. This transverse incision allows one to turn back a flap of tissue that helps materially to protect the rectum from injury. One should then proceed to the enucleation of the prostatic tissue. Exceptionally this may be done with the finger alone. Often one may use a rather dull periosteum elevator to advantage, cutting with its edge. In the majority of instances one must nibble away with a rongeur forceps a little at a time, such of the disease as he can get. In order to relieve the obstruction to urination it is especially necessary that the dense tissue that surrounds the bladder outlet be removed very thoroughly. This can be done sometimes with curved scissors, sometimes with the prostatic punch,and sometimes with rongeurs. It is my custom to put a catheter in the urethra and perineal tubes through the wound. For the last year or more it has been my custom to drive small needles containing radium into any little masses of suspicious tissue that remained. These needles are ordinarily left in place from twenty-four to forty-eight hours, depending upon the thickness of the issue left; the dose of radium used has usually been 25 mgm.

The convalescence in cases of this sort is not different from the convalescence following the ordinary prostatectomy for benign disease except that I think malignant cases, as a whole, show an unaccountable lack of vitality not seen in the ordinary benign cases. In 26 of this series of 35 cases the operation was carried out in the above manner. In 7 of these cases spinal anaesthesia was used rather than inhalation anaesthesia; this, in spite of the fact that the position with the hips elevated is not the ideal one for this form of anaesthesia.

In our palliation of this condition it is even possible to re-operate upon some of these patients who have a reoccurence of their obstruction. I have done this in one instance only though I have suggested it in several. The operated case concerned a man operated upon in 1914 for prostate that was clinically and microscopically malignant. A few months before I saw him in 1919 his obstruction had recurred and as he had little cachexia I again did a perineal prostatectomy. Following this second operation he had very little control of his urine but some little time after operation his general condition was very satisfactory, although he has not been heard of recently.

As to the results in this series of cases one man of eighty odd died in the hospital: a death one may fairly consider the result of operation; four died in from six weeks to six months after operation; they all left the hospital but were never more than convalescent; they died without having any adequate increase in comfort from their opration; they may be considered failures as far as giving any real relief is concerned. On the other hand in three of these five cases there was retention with great difficulty in the use of a catheter and they would have had to have a cystostomy or be allowed to go on without any attempt being made to give them relief.

Of the 30 remaining cases 7 are known to have died, one two years after operation; he died as the result of an automobile accident, but I regret to state that his automobile trip was being made so that he might re-enter a hospital under my care. The autopsy showed that several ribs were fractured and that the fractures were at the seat of metastatic foci of carcimona; no cancerous foci were however, found in the bones of his fractured legs. In this patient there had been a lateral extension of the disease in the pelvis. There were metastases in his lungs and one in his heart muscle; this was a patient on whom I carried out a suprapubic prostatectomy, enucleating the prostate in practically one mass The removal was difficult and was my first intimation that this man's disease was carcinoma. The nature of this growth had not been recognized as at examination it was covered with a soft edema, a condition that often obscures the typical feeling of a

malignant growth. Another of these patients lived two and one-half years after operation and was able to keep at his work, that of a crossing-tender, up to within three weeks of his death. It is an important thing with a laboring man, suffering from long drawn out and necessarily fatal disease to be able to keep him at work as long as possible. Three died of intercurrent disease; it was expressly stated of two that they had been free from urinary symptoms; nothing was said regarding this in the case of the third.

The sixth died of a recurrence nine months after operation. He had had a relatively short period of only moderate relief. The seventh died a few months after operation but the cause was not stated. I have lost sight of 4 of these patients. I presume they have died. Nineteen of this list of 35 patients were known to be living within a short time. One of these, the first of this series, operated upon three years ago was reported as well within a few weeks. One operated upon three years ago was reported as well within a few weeks. Four are alive two years after operation; one of these should be re-operated but the others are comfortable; another operated upon a little more than a year ago and seen within a short time says that he never was better; this man was treated with radium at the time of operation, as nearly all of the recent cases have been.

Of 13 cases operated upon within a year 5 are reported as being comfortable. One is very uncomfortable with what I believe is without a doubt a local recurrence; another had a pathological fracture of a femur some weeks ago. X-rays of this were reported as showing metastatic carcinoma at the site of fracture. The others have been operated upon too recently to allow us to draw any useful conclusion regarding them.

I have two cases to add to this number that are encouraging; they did not come in this series of cases but were both operated upon in 1911. Both presented themselves because of urinary obstruction. The first case was clinically carcinoma of the prostate. The late Dr. Authur T. Cabot concurred in the diagnosis; all the tissue I could get was removed by the perineal route; it was macroscopically and microscopically carcinoma. I saw this

patient several times during the past winter. He is the picture of health and has no symptoms whatever. The second patient was likewise operated upon in 1911 for what was clinically and microscopically carcinoma. I examined this man in 1917 at which time he was apparently perfectly well. He was reported as well at a later date though as no note was made at the time I cannot give the date.

These figures would be very disheartening if they applied to anyting but to a condition that is necessarily fatal, if untreated. It is true that we have reason to believe that the natural history of cancer of the prostate, is that it often progresses very slowly. I believe, however, that once the condition has begun to give marked symptoms, especially obstruction, that the patients are only exceptionally comfortable unless they submit to operation. The perineal removal of the growth can be done with little more risk to life than a cystostomy and a considerable proportion of these patients are able to go back to work for quite a period following operation; one worked for more than two years. Not only do we give a considerable degree of palliation but the careful operative removal of the growth will bring about in rare instances what is apparently a cure, clinically speaking. It seems probable that the use of radium as an adjunct to the operative removal of these growths will better the chance for cure, and also give longer periods of remission of symptoms.

It is my conclusion, that in all instances where a malignant prostate is producing obstruction to urination it should be removed unless the patient's general condition is such as to absolutely preclude this. That in the cases in which patients complain of pain in the thighs or sacrum, the perineal removal of the growth will give temporary relief in some of the cases. That operation, in carcinoma of the prostate should be carried out by the perineal route and that radium should be left in any bits of suspicious tissue that remain, or in the cavity from which the prostatic tissue has been removed. That the removal of these growths may be carried out with relatively little risk when done by the perineal route; that there is little probability of a permanent fistula.

CARCINOMA OF PROSTATE

B. S. BARRINGER

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Carcinoma of the prostate presents as many complexities of diagnosis and treatment as any other disease of the urological tract. The internal situation of the prostate, the confusion between carcinoma and adenoma, the quiet, often symptomless, invasion of the prostate by the carcinoma, the urinary retention, the conflict between operative and radium treatment—these are some of the phases. In this paper only the most important problems of diagnosis and treatment are considered. It is especially an attempt to bring up-to-date the report of readium therapy in carcinoma of prostate as practiced at the Memorial Hospital.

GROSS PATHOLOGY

Types of malignancy

The two following histories with their post-mortem data represent two types of malignancy between which extremes all variations occur.

1. J. S. W. Age sixty years. Admitted to Memorial Hospital September 11, 1919, with a history of frequency of urination and prostatic retention for a number of years.

The examination of his prostate (by rectum) revealed a very large, irregular, stony hard prostate fixed to pelvis. Indurated masses extended along right and left vesicles. The top of these masses could not be felt. Residual urine 4½ ounces, the patient was very thin and cachectic. Radium had no effect, that could be determined by palpation, upon the carcinoma. He gradually grew worse and died December 3, 1919. The post-mortem record showed "Kidneys: ascending suppurative pyelonephritis. Prostate: measures 4 by 5 cm. laterally and 2.5 cm. vertically. Structures are obliterated by opaque tumor tissue which fungates through the base of bladder at trigone, 3 cm. wide.

Rectal wall is slightly adherent but not involved. Peritoneal surface behind bladder base shows superficial subserous nodules. *No enlarged lymph nodes were found.* The carcinoma has not extended above the seminal vesicles."

2. J. S. Age seventy-four years. Admitted to Memorial Hospital August 24, 1916. His chief complaint was a tumor mass on left jaw. Seven months previously had a severe facial neuralgia, then a small lump on left cheek anterior to ear. This increased in size. Lost weight and strength rapidly, 34 pounds in a "short time." Lately has had some "stomach trouble." The physical examination showed: Mouth, no teeth in either jaw. Above left molar region of inferior alveolar process is a small area of tumor, size of a 5 cent piece. Extending into adjoining buccal mucous membrane is a hard tumor growth which involves the whole side of inferior maxilla producing a large tumor of left cheek. Tumor is hard and fixed to inferior maxilla. Rectal examination showed prostate slightly enlarged and very irregular Left lobe larger than right. Small hard nodules on surface, no perivesicle enlargement. Diagnosis:—*probably primary prostatic carcinoma with* metastases to jaw.

The post-mortem showed: Kidneys, left pyelitis and chronic productive nephritis. Right pyelitis. Bladder; chronic suppurative cystitis. Prostate; left lobe slightly enlarged, shows pea-sized nodules projecting from posterior surface. At entrance to prostatic urethra surrounding orifice are a few soft pea-sized papillary projections. Running up spinal column series of slightly enlarged lymph nodes becoming more marked in thorax, replaced by soft tumor tissue. Thorax, process from lymph node invades body of 4th and 5th dorsal vertebrae. This process circles spine and invades the periosteum of 6th and 7th ribs largely destroying both. Entire left inferior maxilla is destroyed by soft tumor process, which invades the periosteum and replaces bone. Diagnosis: Carcinoma of prostate. Secondary carcinoma of inferior maxilla invasion through spinal lymph nodes.

In the first case (of low malignancy) notwithstanding the length of duration of the disease and the very large prostatic carcinoma, the carcinoma did not go above the seminal vesicles. In the second case (highly malignant) the changes in the prostate were so slight as to make the diagnosis of carcinoma only "probable," yet the metastases were very large and extensive.

Both of these extreme types are rare and all graduations between these are seen. The usual type is a slow growing tumor which because of the limiting fascia of Denonvilliers on the one side and the bladder base on the other, generally grows in the line of least resistence, upward into the lymphatics around the seminal vesicles, and metastasizes very early in its life history.

Frequency of growth beyond the prostate

In 2 cases the carcinoma as far as could be determined by palpation was confined to the prostate. A third case was borderline The remaining 142 cases showed extensive either toward the vesicles, to the bladder, to the lateral walls of the pelvis or metastases to more distant parts of the body.

Lateral pelvic extension

The commonest extension of a prostatic carcinoma is towards the seminal vesicles. A second extension may be to the lateral pelvic walls. From either prostato-vesicular junction a bridge of dense carcinomatous tissue is felt extending to each ramus of the pubes.

This is a common extension and one not usually described.

Rectal extension

There have been but 3 cases of growth of the carcinomata through the rectal wall at the site of the prostate. This growth was accompanied by vesico-rectal or urethro-rectal fistulae and is not to be confused with the peri-rectal growth often occurring above the seminal vesicles and causing rectal stricture.

Anterior urethral metastases

One of the 145 cases had metastases in the anterior urethra. This was either a retrograde lymphatic growth or a direct implant into the urethral mucous membrane. In this case metastases occurred after a Young punch operation on the bladder neck and carcinomatous tissue broken loose might have formed a transplant. This patient also had a secondary nodule of the head of the penis.

I have seen one other case which had a peri-urethral metastases some centimeters back of the head of the penis. In this case there had been no operation on the prostate or urethra.

Distant metastasis

Our records are too imperfect to determine how frequently prostatic carcinoma metastasises to the pelvis, lumbar spine, lungs, long bones, glands, etc. Bumpus[1] has lately published records on the frequency of these metastases.

PROSTATIC CARCINOMA SECONDARY TO BLADDER CARCINOMA

A bladder carcinoma usually starts in the mucous membrane of the bladder, and grows in the line of least resistance, that is, into the cavity of the bladder. Nothing hinders its growth in this direction. So having ample space within which to grow it metastasises late. When the bladder contracts to expel urine, the mucous membrane folds up and there is not much pressure exerted upon the tumor. A prostatic carcinoma on the other hand has no space in which to grow. In addition to this it is limited posteriorly by the dense fascia of Denonvillier's fascia and anteriorly by the less dense fascia of the bladder base. This tension, so to speak, in which the prostatic carcinoma is held is one factor in causing it to extend beyond the prostate and metastasise early, and if metastasises most often upwards between these two limiting fascias. Probably a contributing factor to early metastasis is the pressure exerted upon the carcinoma when the bladder sphinceter contracts at the end of each act of urination. Because of these conditions it is rare for a bladder carcinoma to grow by the difficult route and invade the prostate, but rather common for a prostatic carcinoma to break through the fascia at the bladder base and invade the bladder. The following case is the only of the series in which the picture was that of prostatic carcinoma but the pathological report showed a squamos celled carcinoma undoubtedly originating in the bladder.

[1] Carcinoma of the prostate. Surg. Gyn. and Obstet., January, 1921.

G. G. H. Age sixty years. First seen July 5, 1920. In October, 1919, frequency of urination. February, 1920, impotence. Never hematuria.

The prostate shows a hard tumor mass of the posterior lobe of the protate 2.5 by 3 cm., stony hard fixed and irregular and one cannot feel above the prostate to determine the condition of the vesicles. Complete retention of urine.

December, 1920, suprapubic prostatotomy to relieve retention of urine. All around the internal urethral orifice are regular carcinomatous nodes very extensive, forming valleys and hills. The whole bladder base is indurated. a typical picture of a prostatic carcinoma growing into and behind the bladder wall. The patient died uremic, January, 1920. The pathological report (Dr. Ewing) follows:

"The tumor has the structure of an epidermoid carcinoma, the cells being broad, flat, and mostly of distinctly squamous character. It shows none of the glandular features of prostatic carcinoma, and it appears quite improbable that it has any other origin than from the bladder mucosa.

"The radium changes are notable. The first changes consist of extreme swelling and hyperchromatism, often followed by disintegration of the nuclei. Many of these cells form giant masses. Hydropic swelling is also present. Later the cell groups break up, and become very hydropic, while the surrounding connective tissue reacts with production of much cellular granulation tissue. Finally the tumor cells disappear, often leaving giant cells or points of necrosis, much resembling miliary tubercles."

Early symptoms—145 cases

1. *Disturbance of urination.* One hundred and fifteen had as a first symptom either dribbling, dysuria, nocturia, frequency, difficult urination or retention, or a combination of these.

Eleven had as a second or subsequent symptom some disturbance of urination.

2. *Hematuria.* Eight had this as a first symptom, and 25 as a second or subsequent symptom. Of 33 cases which had hematuria as a symptom it is definitely stated that the bladder had a secondary carcinoma in 18.

3. *Pain (not associated with urination).* Seven had pain as a first symptom — 3 in the back, 1 back and hip, 1 pain in heel,

1 in prostate, 1 abdomen, 5 had pain as a second symptom. One pain in groin, 1 pain in buttocks, 1 sciatica, 1 in thigh, 1 in leg.

Unusual symptoms

One patient had as a first symptom odema of legs, 1 swollen testicles, 1 constipation, 1 bleeding from rectum. There is nothing in the symptoms that can distinguish carcinoma from non-malignant enlargement of the prostate, although in the latter a history of hematuria is somewhat more frequent.

Age—129 cases

Thirty to forty years: 2 cases.
Forty to fifty years: 5 cases.
Fifty to sixty years: 33 cases.
Sixty to seventy years: 59 cases.
Seventy to eighty years: 27 cases.
Eighty to ninety years: 3 cases.

Here again the age incidence runs nearly parallel to that of hypertrophy of the prostate.

Time elapsed between time first seen and the first appearance of symptoms

Ninety-three cases of prostatic carcinoma with the growth extending beyond the prostate.

One to two months: 15 cases.
Two to four months: 12 cases.
Four to six months: 11 cases.
Six to twelve months: 19 cases.
Twelve to eighteen months: 7 cases.
Eighteen to twenty-four months: 8 cases.
Twenty-four to thirty-six months: 7 cases.
Thirty-six to forty-eight months: 4 cases.
Forty-eight to sixty months: 6 cases.
Sixty to seventy-two months: 3 cases.
Seventy-two plus months: 1 case.

One unusual case was that of a patient with extensive carcinoma of the prostate who had a prostatectomy for prostatic carcinoma

nine years previously. The hopelessness of curing many cases of carcinoma of the prostate if we do not radically change our method of approach is shown by these figures. Notwithstanding that one out of seven cases came within the first two months. After the appearance of symptoms, that one out of three cases came to us within six months, and that two out of three within the first year of symptoms, in all of these cases the carcinoma had grown beyond the prostate. We are inevitably forced into the conclusion that regular examination of the prostate of all over the age of 50 irrespective of the appearance of symptoms is the only rational method to hope to get these cases early.

Examination

The routine examination includes rectal palpation of the prostate with a thin-gloved finger, with and without a sound in the urethra. Special attention is paid to peri-vesicle induration, or lateral bands to the pelvic walls. Stricture of the rectum occurs high above the vesicles as pointed out by Geraghty, and normally can just be reached with the tip of the finger. All of the superficial lymph nodes are palpated as also the penis for carcinoma. Any swelling of the legs is noted.

The amount of residual urine is measured as also the kidney function, and cystoscopy is done. It is not practicable to radiograph the whole body for metastases to the bones. As metastasis most often attacks the lumbar spine and pelvis, one plate is taken showing both of these. This radiograph may also be used to exclude stone of the prostate, the one condition most stimulating carcinoma. I have on one occasion used a long needle inserted through the perinaeum into the prostate (novocain anesthesia) to make the differential diagnosis. The needle distinctly grated upon the prostatic stone. Of the 145 cases of prostatic carcinoma seen at the Memorial Hospital, I have never come across a stone in the prostate. And in all of these the prostatic region had been either radiographed or needled.

Pathological examination

We have developed at the hospital[2] a needle which has proved to be of value in the diagnosis of doubtful cases. This needle has a small cutting screw at the point, with which prostatic tissue is obtained. The needle is inserted through the perinaeum (novocain anesthesia) into the prostate, a finger in the rectum guiding it. We have used this needle 33 times, in 16 of which prostatic tissue was obtained, 9 of these proving to be carcinoma. It should only be used in cases in whicn the diagnosis is in doubt.

TECHNIQUE OF RADIUM APPLICATION

1. Prostate needle

The technique first used at the Memorial Hospital in October 1915, is still with us the most efficient and least painful method of destroying carcinoma of the prostate. A steel needle 10 to 15 cm. long of 18 gauge is used, 50 to 100 m.c. of radium are placed in the end (terminal 3 cm.) of the needle. Under novocain anesthesia with a guiding finger in the rectum the needle is inserted through the perinaeum into one of the lobes of the prostate. Then at the end of the treatment for that lobe the needle is withdrawn from the prostate (but not entirely out of the perinaeum) and inserted into the second lobe. A carcinomatious mass 2 cm. in diameter will stand an initial radium dose of 300 to 400 m.c. hours. This may be repeated in smaller dose in two to three months. We have in certain cases used smaller doses at shorter intervals (25 to 50 m.c. every week). But I have no evidence that this method does any more than the above.

2. Seminal vesicles—needles

The seminal vesicles are radiated routinely if the size of the prostate does not prevent their being reached. Sometimes they are more easily reached through the rectum than by the perineal route, and in some cases we have so radiated the vesicles. A guiding finger is put into the rectum, and a small canula is inserted

[2] Dr. Goeller of our staff is responsible for this.

up to the vesicles. The needle is put through the canula, and so into the vesicle. The lower rectum is previously cleansed with soap and water. We have had no infections of the vesicles, following this rectal method.

3. Bare tubes in prostate and seminal vesicles.

Bare tubes of radium (small doses of radium unscreened except for glass container, and therefore localized and caustic in action) have been used in both prostate and any extension beyond the prostate, but have proved not as efficient as the "needle method" and most painful.

4. Urethral

The use of radium in the urethra has been limited to those cases in which the carcinoma has directly invaded the urethra. Tubes of screened radium (rubber 1 mm. silver 0.6 mm.) 2 cm. long are attached to a linen thread and inserted into the bladder through the sheath of a urethroscope. The urethroscope is removed and the tubes pulled out into the prostatic urethra by the attached thread. When the treatment is finished the tubes are pulled out of the urethra. 200; mc. hours is a mixiumum dose. This may be varied by using the silver tube in the end of a urethral catheter.

5. Rectal

We have treated but a few cases with screened radium in the rectum. This method does not seem to be as efficient as the "needle method" and produces more pain.

6. Residual urine

In most cases the residual urine can be prevented from increasing and in a few it can be decreased by the "needle method" of radium treatment.

If this has no effect and the presence of residual urine causes alarming or intolerable symptoms then we resort to:

a. Bare tubes of radium in the bladder neck. A bare tube of radium (6 mc.) is placed in the end of a flexible needle. This needle by means of a McCarthy urethroscope or Buerger operating cysto-

scope may be plunged into the prostate at the lower part of the bladder neck. By a plunger the bare tube is pushed out of the needle into the prostate and left there. Its action is local and caustic.

b. If the residual urine does not reduce after this then we resort to the Young punch operation or suprapubic drainage or suprapubic partial prostatectomy.

7. Pain

Pain caused by growth of the carcinoma around the pelvic or spinal nerve has rarely reacted to radium or X-ray treatment.

8. Swelling of legs

This symptom caused by pressure of the carcinoma on the veins has been successfully combated by the radium pack. This is placed on the abdomen and centered over the vein compressed; from 10,000 to 15,000 mc. hours are given.

9. Rectal stricture

I have had one case in which I inserted bare tubes (2 of 5 mc.) into one segment of the stricture. They are inserted through the rectum. This procedure relieved the constipation and made unnecessary a colostomy operation.

RESULTS OF RADIUM TREATMENT

Report of 4 cases of 145 which have gone three to five years after first radium treatment, and have shown regression of the carcinoma.

Case I. C. D. Age fifty-nine. First seen October 15, 1915. Complained of loss of flesh and strength (some 25 pounds) and night frequency (from 3 to 4 times) for four months. He has had pain in right thigh for five years. Prostatic examination (with Dr. Keyes) reveals a large, hard, fixed, irregular prostate, each lobe as large as an English walnut. The left lobe was more prominent than the right, and there was but little extension toward the seminal vesicles as far as could be felt. No residual urine. A radium needle of 50 mc. was placed in each lobe of his prostate for six hours, on October 20, 1915.

January 14, 1916, the patient has gained about 10 pounds. Examination of the prostate reveals marked shrinking of the carcinoma. 60 mc. of radium (by needle) was placed for four hours in each lobes of the prostate.

February 18, did not get up at night to urinate, and had gained 8 pounds. Slight induration at the base of the prostate. Right lateral lobe treated for 8½ hours with a needle of 30 mc. of radium.

February 27, 1919, up twice at night, working a full day. Weight the same; 64 mc. of radium in left lobe six hours.

November, 1919, up at night, none. Weighs 127 to 130 pounds. Prostate and vesicles feel entirely normal (examination with Dr. Keyes).

January, 1921, five years and 3 months after first radium treatment prostate and vesicles normal. 2 years and 3 months after last radium treatment. Patient in excellent condition.

Case 2. A. S. Age 66. First seen October 10, 1916. He had night frequency of urination for two years. He now dribbles by night, and urinates every two hours by day. Prostate very large, and somewhat irregular but not suggestive of carcinoma. Residual urine, 1,000 cc. Cystoscopic examination shows a horse collar prostate. Dr. Keyes did a prostatectomy and Dr. Ewing reported that the specimen showed carcinoma.

November, 1916, the patient had 50 mc. of radium in what remained of the prostate, for eight hours.

January 9, 1917, increase frequency for the past three or four days. At night urinates every half hour. Prostate feels slightly lumpy in lateral lobe. He had another treatment of radium at this time.

February 3, patient had retention of urine, and had to be catheterized three times a day. Radium treatment.

February 27, patient had complete retention of urine, and a permanent suprapubic tube was put into his bladder.

June 20, the patient has had severe pain in the last two months in his prostate requiring morphine. The examination shows a prostate irregular, scarred and carcinomatous. Th evesicles are indurated, especially the left.

October 15, the patient is in excellent shape physically. He has a collection of calculi around his suprapubic tube. The prostate is flat, the left seminal vesicle has some lumps in it, and is slightly indurated.

January, 1918, radium left seminal vesicle and prostate.

April, 1918, the patient is in such a good shape that I sewed up his suprapubic opening and he left the hospital emptying his bladder.

June, 1919, in the best of shape, (examination with Dr. Keyes). There is the same ridge in the left vesicle, the patient empties his bladder and his prostate feels normal. He is not treated with radium because it is a question if he has any carcinoma left.

January, 1921, four years and three months after first treatment, and three years after last radium treatment. Examination the same as in June, 1919. Parent in excellent condition.

Case 3. M. B. P. Age sixty-four. In January, 1916, a prostatectomy was done by Dr. Downes at St. Luke's Hospital. The prostate was found on pathological examination to be carcinomatous. His urethra did not stay open after the prostatectomy, the patient beginning to have increasing retention of urine, and his bladder neck was fulguarted in the attempt to keep the prostatic urethra open. First seen by me on April 2, 1917. At that time he had a certain amount of residual urine, but I was unable to get a Philips' whip into his bladder. Prostate was large and soft. Could not feel above it. There was obstruction in the prostatic uretha. The suprapubic wound drains irregularly. He was treated with 50 mc. of radium in the right lobe for six hours, and similarly in the left lobe.

May 4, urinates twice at night, and can go five hours without urinating. Before the radium he urinated every one to two hours.

June 5, 60 mc. of radium in the right and left lobes of the prostate, each six hours.

October 27, up once at night, and more radium to the right and left lobes of the prostate.

March 1, 1918, three weeks ago, 50 mc. of radium for seven hours and 15 mc. of bare tubes imbedded in the right side of the prostate. This burned him considerably, and was probably too large a dose.

August 16, 1919, has a residual of about 3 ounces. I got a 22 French into his posterior urethra. Suprapubic wound still open at times. Urine is very foul.

December 5, 1919. goes five hours without urinating at night. Very small hard lump in left apex of the prostate. Is it carcinoma? He has had no radium for one year and nine months, the rest of the prostate and vesicles show nothing. He is the picture of health (examination with Dr. Keyes and Dr. Mohan).

April, 1921, four years after first treatment and three years and two months after last radium condition continues excellent. His suprapubic wound leaks at irregular intervals. Residual 1½ to 2 ounces.

Case 4. P. J. H. Age fifty-five. First seen July, 1917. History of urinary frequency for three weeks. By day every hour, by night 6 to 7 times. Some pain in left groin and testicle and at end of urination. Lost 10 pounds in weight. Rectal examination showed a not very large prostate, but very hard and irregular carcinoma running into left vesicle (confirmed by Dr. Keyes). Cystoscopy shows an irregular bladder base and irregular bulging of prostate into bladder. Residual none. A steel needle holding 95 mc. of radium was placed in left prostate for four hours. Lost track of until May 7, 1920. (He had during this interval been operated upon for osteomyelitis of skull.) Prostate feels absolutely normal. Both vesicles sclerosed (confirmed by Dr. Keyes). Urinates once at night and five times by day. In excellent health.

May, 1920, bare tubes of radium in vesicles.

January, 1921, three years and five months after first treatment and one year after last radium treatment condition remains excellent.

In these 4 inoperable cases the prostates and seminal vesicles were somewhat irregular, scarred, but others normal. They are the only cases which have gone a sufficient length of time since the first and last treatments to report. They all show mankind regression of the disease.

Results in 2 cases in which the carcinoma was confined to the prostate and one borderline case out of 145 cases seen.

Case 1. J. C. Age seventy years. First seen in February, 1916. He gave a history of urinary frequency, chiefly at night (3 or 4 times) for the past six months, then acute retention. Lost about 8 pounds. The rectal examination of his prostate showed a flat irregular prostate with prominent nodules at prostato-vesicular junction extending into the vesicles. He was treated several times with radium needles through the perineum. He had no more attacks of retention, his general health improved and his prostate remained soft and irregular but showed nothing to justify treatment.

In December, 1919, his left vesicle seemed slightly enlarged and radium was recommended under suspicion it might be carcinoma. The prostate was flat and soft.

In August, 1920, he had an attack of severe pain in the back and left side and was confined to bed. I saw him then when he looked near death, was confined to bed with what was probably involvement of

his spinal cord by the carcinoma. His prostate felt as normal as in December, 1919.

Case 2. Age sixty-one years. First seen in August, 1919, with a history of fifteen months dysuria, a small urinary stream and frequency of urination, and then finally complete retention. He came to the Memorial Hospital from Bellevue Hospital with a retention catheter in his bladder.

On September 5, by means of the cystoscope, a bare tube of radium of 6 mc. was placed in the median lobe of his prostate.

On September 23, the residual had fallen to one ounce, and he got up 2 to 4 times at night to urinate, and at times during the day goes four hours without having to urinate. Because of some lumps in his prostate more radium in the form of bare tubes were put in this on September 30. Following this treatment he began urinating every half hour by day and night notwithstanding that his residual urine was only half an ounce. He became steadily worse and finally died uremic. He had chills and fever for a couple of weeks before his death, and his death was probably due to infection from his prostate and uremia.

Case 3 (*Border-line case*). J. W. C. Age seventy-one years. First seen December, 1919, with a history of hematuria nine months previous. Following this he had frequency of urination and urgency. When seen his night urination was 6 to 7 times. Urine has been steadily bloody, for the past 40 days. Residual urine is 2 ounces. His prostate was large as a hen's egg, a hard single lump, no enlargement as far as can be felt around the seminal vesicles. He had had 2 treatments of radium needles in his prostate which has very markedly gone down and he is still under treatment.

Summary: One of these cases is still being treated. One is dying of what is probably a metastases to his spine. One died uremic.

RESULT IN VERY EXTENSIVE CARCINOMA OF THE PROSTATE WITH COMPLETE REGRESSION OF THE CARCINOMA AT POST-MORTEM REPORT

G. T. fifty years of age. First seen at the Memorial Hospital August 23, 1919. He had three weeks previous to this, partial resection of the bladder for carcinoma at another hospital. This carcinoma of

the bladder was presumably secondary to a carcinoma of his prostate. When the patient was first seen his prostate was very hard, the size of a tangerine with a number of very hard nodules in it. The vesicles at the base of the bladder were involved by growth. He came to the hospital with a suprapubic drain. Cystoscopy showed a recurrence at the site of the bladder resection. He was treated by radium and lost track of up to January, 1920.

When seen in January, had a recurrence in the abdominal incision, 3 large lumps each the size of an English walnut which were treated by bare tubes of radium.

In January, he was almost exsanguinated because of hematuria and his bladder was again treated with radium.

February, 1920, he had a carcinomatous mass from the symphysis to the anterior superior spine on the right side. On the left side was a mass in the inguinal region 8 cm. wide from the symphysis midway to Poupart's ligament, an enormous carcinoma of the lower abdomen.

In May 1920 all the abdominal masses were entirely gone and his prostate markedly shunken. In November, he went on an auto trip, was chilled, could not void, doctor tried to pass catheter; ten days later he was admited to the hospital uremic, and died November, 1920.

Post-mortem examination was as follows (Dr. Ewing):

"A section from various portions of the bladder, prostate, pelvic and lumbar lymphs nodes failed to show any trace of carcinoma. The wall of the main bladder cavities were everywhere lined with a slough which was very extensive, a diffuse phelgmonous inflammation. Lungs showed purulent bronchitis and pneumonia. The kidney acute nephritis, prostate necrotic.

RESULTS IN SUPRAPUBIC PROSTATOTOMY TO RELIEVE RETENTION

This operation has been done in the following way:

Through a suprapubic opening in the lower part of the bladder neck has been bitten out with a long Rongeur forceps. The operation, aside from using the forceps to bite out the carcinoma, is done precisely in the same way that a suprapubic prostatectomy for adenoma is performed. I have only done it in cases of urinary retention (generally complete) which could not be managed by catheter or which could not be overcome by any of the other described methods. In all cases in which it was done the carcinoma

was very advanced. Eight cases in all have been operated upon. Seven cases left the hospital after operation, 1 died in the hospital two months post-operative from the growth of the carcinoma around the ureters and failing kidneys. Three were lost track of, after they left the hospital. Two patients went two years and three months empting their bladders, and then died. One of these had partial daily incontinence of urine. Wherever practicable the prostate had been thoroughly radiated for a number of months previous to the operation.

RESULTS IN CASES TREATED BY RADIUM NEEDLE IN PROSTATE IN WHICH RESIDUAL URINE HAS NOT VARIED OVER A NUMBER OF YEARS

Case 1. No residual, October, 1915. Treated by needle in prostate, never any residual to January, 1921.

Case 2. No residual, but 1 attack of acute retention, February, 1916. Radium needles in prostate, never any residual and no attacks of retention up to August, 1920.

Case 3. Operation removed carcinoma from bladder neck secondary to prostatic carcinoma, May, 1916. Radium needles in prostate. Up to April, 1919, no residual urine.

Case 4. Operative removal of carcinoma of prostate, October, 1916. Several acute retentions followed this. Then retention catheter. Radium needles in prostate. From April, 1918 to January, 1921, no residual urine.

Case 5. Residual 6 to 8 ounces, October, 1917. Radium needles in prostate.

April, 1918, residual 1½ ounces.

January, 1921, residual again 8 to 10 ounces.

Case 6. Residual, April, 1917, ?, but no instrument could be introduced into bladder. Radium needles in prostate.

August, 1918, to January, 1921, residual 1 to 3 ounces. A 22 French catheter may be introduced into bladder.

Case 7. No residual, July, 1917. Radium needle in prostate. No residual, January, 1921.

These are 7 cases out of the first 43 (cases in 1916 and 1917) which are still living, and which have been observed long enough to give an accurate idea as to the effect of radium on maintaining

the capacity of the bladder to empty itself. In none of them has the residual urine increased and in 1 (case 6) it probably has decreased.

RESULTS WITH RADIUM (BARE TUBES) IN BLADDER NECK TO REDUCE RESIDUAL URINE

Case 1. P. D. April, 1918, residual urine 260 cc. He had 7 mc. (bare tube) of radium, the lower part of bladder neck.

In July, 1918, he had no residual urine.

Case 2. J. A. September, 1, complete retention for a number of weeks. Retention catheter September, 5, A bare tube of radium 5 mc. in bladder neck. September 23, residual urine, 1 ounce.

October 21, residual urine ½ ounce.

Case 3. J. C. Complete retention for two weeks. Retention catheter. Bare tubes of radium 6½ m.c. in bladder neck. Five days later empties his bladder continuing to do so for six months.

We have tried this method in 4 other cases with no effect on the residual urine. It is a procedure not without danger, as 1 patient who had an extensive carcinoma of the prostate with foul urine and complete retention died two weeks after bare tubes were placed in his bladder neck. He died outside of the hospital.

Before it is done the patient's bladder should be gotten as clean as possible, his kidney function determined, and he should be in the hospital.

YOUNG PUNCH OPERATION

This has been performed in 4 cases, in 2 without success; in 1 patient went from a complete retention of urine to 1 to 2 ounces of residual urine, but died 2 weeks after the operation from infection of his kidney. The fourth patient left the hospital emptying his bladder within an ounce, and 1 year later was heard from. At that time his suprapubic fistula had reopened so the success of the operation was not determined.

SUMMARY OF METHODS USED TO REDUCE RESIDUAL URINE IN CASES OF CARCINOMA OF THE BLADDER

Sometimes the needle method in the prostate reduces the residual urine; sometimes the bare tube in the bladder neck does this, but this method is accompanied by considerable pain and some danger. Occasionally the Young punch operation works as does nearly always the more major operation, suprapubic cutting out of the lower part of the bladder neck. The problem is the most difficult one with which we have to deal in these cases, and the ideal procedure in intractible cases has not yet been found.

RESULTS IN REDUCTION OF SWELLING OF THE LEGS CAUSED BY METASTATIC CARCINOMA

We have had 2 cases of this sort, in which the reduction in the swelling of one or both legs by means of a radium pack has been accomplished. In 1 of these patients who had swelling in one leg, and considerable disability the swelling reduced 1 month after the radium pack, and the patient lived in comparative comfort until he died of a cerebral thrombosis. In another patient who had swelling of both legs and edema as far as the umbilicus, the application of 1 radium pack over the right lower abdomen succeeded in reducing the edema within 1 week after its application. Both of these cases had very extensive carcinoma of the prostate and no attempt was made to treat the carcimoma itself.

CONCLUSIONS

1. In but 2 per cent of cases of carcinoma of the prostate seen at the Memorial Hospital is the carcinoma confined to the prostate.
2. Routine prostatic examination of all patients over the age of fifty is the only method by which these cases may be diagnosed as malignant.
3. The results of radium treatment of carcinoma of the prostate are superior to operative removal both in causing regression of the disease, and in copeing with urinary retention.

DISCUSSION

Dr. G. G. Smith: In the Huntington Hospital we have had 24 cases of carcinoma of the prostate. Some of these were too far advanced for any treatment. In others I tried various methods. I have treated them with needles through the perineum and I have tried perineal operation, putting in the needles afterward. I much prefer perineal prostatectomy, followed by the insertion of radium. In two cases I did practically a complete prostatectomy. One case lived about six months following operation; the other has lived now for over a year, and empties his bladder completely but he has incontinence, has metastasis in the groin. In another case I took out practically all the prostate; he has now lived two years and is showing the effect of metastasis, but the bladder function is perfect and the base of the bladder shows no evidence of malignancy. One case treated by needling through the perineum died two months later. Autopsy showed an abscess around the prostate and base of the bladder. Unless you have it very thoroughly screened it seems to me you are bound to get quite a layer of necrosis around the needle. If you are near the periphery of the gland you may get an abscess and consequently I am very much in favor of the operation, reinforced by intelligent and extensive use of radium.

Dr. Cunningham: I would like to add to this important discussion a brief summary of certain features in connection with six patients with carcinoma of the prostate upon whom I was fortunate enough to obtain autopsies.

The growths in each of these cases were classified as adenocarcinoma. All died of metastasis.

The ages of these patients were 56, 59, 68, 72, 73, 74 years.

As has been pointed out during the discussion, that disease may be present in the gland without producing symptoms for considerable periods of time. In this series of six post-mortems,

the time of seeking medical aid, which represents the onset of distressing symptoms, to the time of death was 5, 6, 6, 7, 14, 24 months, which substantiates this view.

The autopsy findings in each in order were as follows:

1. Metastasis in inguinal and iliac nodes, adrenals, aorta, right femur, vertebrae, ribs, and lung.
2. Metastasis in iliac nodes comprising right ureter, at lower end producing a hydro-ureter and hydronephrosis size of a grape fruit, metastasis in lung and on pleural surface.
3. Metastasis in iliac and all retro-peritoneal nodes, and mesenteric nodes; psoas muscle on right, the liver, diaphragm, pericardium, lung, pleura, and bronchial lymph nodes.
4. Metastasis in pelvic lymph nodes, ileum, vertebrae and ribs.
5. Metastasis in inguinal nodes, bilateral, pelvic, retro-peritoneal and mesenteric nodes, liver, vertebrae, lungs, and ribs.
6. Metastasis in left inguinal nodes, pelvic, retroperitoneal and mesenteric nodes. Liver and lung.

While this group in which we obtained autopsies may give a false impression as to the length of life after the onset of the disease, it nevertheless is a representation of facts as to what may occur. It is only fair to say that these cases did not receive the benefit of radium. Continued experience with this disease, however, even with the employment of radium, with or without operation, has not changed my opinion that metastasis must be expected in patients with carcinoma of the prostate: that their failure to develop, sooner or later, is the exception and I believe that metastases are more common and occur earlier than is generally supposed.

Dr. Schmidt: I have practically come to the conclusion that whenever it is possible to diagnose clinically cancer of the prostate, that it is already an inoperative case. I have operated on these early cases where I might state that there is only a suspicion, or in some cases where the condition of cancer was not suspected from above and from below according to the best recognized procedures, and the results have all been unsatisfactory.

I agree with Dr. Lower that it is best to wait for operation until necessity arises. This is particularly true in the obstructive cases, and in these cases I simply make a permanent suprapubic fistula. In these cases, as well as in the cases where the urinary symptoms are not sufficient, I have instituted Radium treatments. The radium has been applied in varying doses through the perineum through the suprapubic region whether operated or not, and also through the urethra and per rectum with the methods in use by most of us.

The suprapubic drainage gives relief from many disturbances and I am rather inclined to believe that it prolongs the life of the individual. I am also rather inclined to believe that radical operative procedures do not increase the length of life nor give as much relief as the palliative operations, whether the latter cases are treated or not treated with radium. To express an opinion of this kind does not mean a step backward, but simply admits that the operative methods for cancer of the prostate are as yet not sufficiently developed.

Dr. QUINBY: For comparison with these cases described by Drs. Chute and Barringer I should like to relate in brief the history of two individuals whom I have recently encountered. One of these was known to have had a definite malignant disease of the prostate for a period of seven years and two months; the other for a period of about eight years. Both these cases were picked up in the x-ray department, and showed generalized metastasis in a large number of the bones of the body. They illustrate a rare type of carcinoma apparently growing so slowly that instead of causing erosion of the bone with possible fracture, they show in the x-ray plate a definite proliferation of the osteoid tissue.

Dr. MACKENZIE: Two important factors in the treatment of carcinoma of the prostate are: (1) The great difference in the degree of malignancy in such growths. (2) The stage of the growth at which the treatment is begun operative or otherwise.

In our service we have operated on eight patients by Young's

radical excision, perineal method. We have removed the obstructing portions (adenoma) in several. We have inserted a supra-pubic permanent drain in many and we have treated some with radium. All satisfactory in a measure—no method totally satisfactory.

TREATMENT OF MALIGNANT DISEASE OF THE PROSTATE AND BLADDER

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PART I

In the past twenty years, there have been registered in the Urological Department of Johns Hopkins Hospital approximately 450 cases of cancer of the prostate. It was the development of the surgery of the prostate which was responsible for the recognition of the frequency of cancer, the pathologist in most instances making the diagnosis for the surgeon.

The frequency with which cancer of the prostate is associated with hypertrophy caused considerable confusion in the clinical diagnosis. In a study made some years ago, in 75 per cent of the cases of cancer, there was an associated prostatic hypertrophy or there had been a previous adenoma present replaced subsequently by cancer. When a prostatic adenoma is invaded by cancer, it is possible to tell from the architecture of the gland that there has been previously present adenomatous tissue. In 25 per cent of the cases, the cancer was unassociated with adenoma. In a pathological study made some years ago, I was able to show quite conclusively that when cancer of the prostate was associated with adenoma, the cancer always began in the posterior lobe or in the portions of the prostate not involved in the adenomatous process. The examination of the material from several hundred cases of adenoma showed that in not a single instance was cancer found in the adenomatous lobes, except where it occurred as a direct invasion of the cancer in the posterior lobe.

Our experience in subsequent years has entirely substantiated the accuracy of these earlier studies. This pathological study explained also the apparently confusing evidence which palpation of the prostate and cystoscopy furnished in many cases. Rectal examination of these cases revealed a prostate definitely carcinomatous, while on cystoscopic examination the picture was typical of benign hypertrophy. In the average cases the diagnosis is not difficult, as the induration, irregularity, the formation of an intervesicular plateau, the extension of the process into the seminal vesicles or toward the membranous urethra are typical of malignancy of the prostate. The changes are not infrequently associated with marked contracture of the prostatic urethra.

Cancer occurs in the same period of life as prostatic adenoma, so that the age of incidence is of little value in the differential diagnosis. Unfortunately, cancer of the prostate seldom produces symptoms until the disease is far progressed. Urinary symptoms, as a rule, are not produced until the vesical orifice or prostatic urethra becomes extensively involved, leading to their contracture. In occasional cases symptoms resulting from metastases are present before the onset of any urinary obstruction.

In early cases of cancer, the patient usually presents himself, not because of symptoms produced by the cancer, but frequently because of symptoms of urinary obstruction resulting from adenoma. In rare cases early cancer is recognized where examinations are made as part of the routine physical examination. In nearly every instance, however, when the patient is first seen, the disease has advanced to the posterior bladder wall or into the region of the seminal vesicles, rendering radical extirpation impossible. In only twenty-one cases out of four hundred was the cancer found confined to the prostate and it was considered possible to excise all of the cancerous tissue. In fourteen cases the radical operation of Young was carried out, and in the remaining seven of the cases a total prostatectomy was done. In this latter group, the growth was well confined to the prostate, thus making possible its complete extirpation without necessitating the removal of the seminal vesicles and neck of the bladder.

It is of interest to note that in all of these cases in which a subtotal prostatectomy or complete removal of the prostate with its capsule was carried out, there has been no recurrence of the disease. It should be noted, however, that in all of these cases, it was possible to remove the cancer with a wide margin of healthy tissue. Young has reported in his series of fourteen radical operations a cure of 50 per cent, but this operation is limited in its application to those cases in which the disease has extended only slightly beyond the prostate.

In our experience in 95 per cent of the cases surgery alone is hopeless so far as complete extirpation of the malignant disease is concerned. Therefore, if we are to obtain a greater percentage of cures, some other form of therapy must be developed, which will secure results, either alone or in combination with surgery. With our present available methods of treatment, the most that we can hope to accomplish is the relief of urinary obstruction or the prevention of its development. Forty per cent of the cases when first seen have either complete retention or obstructive symptoms with a large amount of residual urine. In many of these cases the symptoms resulting from urinary obstruction are distressing and some procedure must be employed to give relief. In 60 per cent only slight or no residual urine is present, and the patient has presented himself principally because of frequency or painful urination. In many of these cases, the symptoms are aggravated and largely produced by an accompanying cystitis.

Radium therapy

The promising and often enthusiastic reports of the value of radium in the treatment of malignant disease promoted our use of radium in cancer of the prostate. This work was begun in 1915. Since that time, radium has been employed alone or in combination with operation in one hundred fifty cases. Up to eighteen months ago radium was used exclusively through the urethra and per rectum against the prostate and seminal vesicles. A platinum capsule containing 100 mgm. of radium was applied for one hour, this being repeated every second or third day, the radium being applied each time at a separate point so that the

applications would overlap as little as possible, and thus minimize the possibility of irritation. From ten to fifteen hours were given per rectum and about five hours per urethram this constituting the first series of treatment. Usually at the end of this time, in many cases considerable rectal irritation was produced, the patients having quite frequent stools with the passage of considerable amounts of mucus. With the first appearance of these symptoms, treatment was discontinued and the patient was asked to report in about two months for a second series. It was usually found in the second series that the amount of radiation which the patient would tolerate without producing marked rectal irritation was distinctly less than in the first series. If possible, some months later the patient was asked to return for a third series. In about 25 per cent of the cases which received 2000 to 2500 mgm. hours per rectum rather distressing rectal symptoms were produced.

Examination of the rectal mucosa in these cases shows a marked thickening and edema with considerable congestion. In some cases ulceration has been noted. The duration of these symptoms after the cessation of treatment usually continues for several months and occasionally for six months or longer. In certain cases developing symptoms of rectal irritation, following the first series of radiation, the resumption of treatment after the disappearance of rectal symptoms is rapidly followed by severe and protracted irritation. In occasional cases the appearance of rectal symptoms is rapidly followed by severe and protracted irritation. In occasional cases the appearance of rectal irritation is delayed for several months after treatment has been discontinued. Local measures directed toward the relief of symptoms have been of little value. Starch enemata have afforded a certain relief in some cases. In our earlier experience in the treatment of these cases per rectum, several very severe radium burns were produced. In one of these a colostomy was carried out because of rectal obstruction, resulting from the intense edema of the rectal tissues. In the other cases the same procedure was done because of severe ulceration with accompanying pain and tenesmus.

During the past eighteen months, we have been needling the prostate in combination with applications per urethram and per rectum. The needles are inserted through the perineum in the manner advocated by Barringer, 12.5 or 20 mgm. needles of radium element being employed, these being left in the prostatic tissue from fifteen to thirty hours giving a total radiation of from 500 to 1000 mgm. hours at each treatment. The urethra receives a series of radiations totaling about 500 mgm. hours, with about 1000 mgm. hours are given per rectum. One advantage in employing the needles is that it brings the radium in intimate contact with the cancerous tissue and decreases the amount of radiation given per rectum and per urethram, thus decreasing the danger of irritation.

Examination of the prostate after the first series of 1500 to 3000 mgm. hours of radium treatment, usually showed a marked change in the character of the prostate. While it was occasionally decreased in size, the most marked change noticeable was in the consistence of the gland. Instead of being stony hard, it was now rather elastic and of a consistence of hard rubber. The change was frequently so marked that one would not recognize the prostate as cancerous. Although these marked changes occurred in the size and consistence of the prostate, the seminal vesicles seemed usually very much more resistant and the induration persisted there a much longer period of time. While one could not deny the marked change which occurred in the character of the prostate, this change tending to make one rather enthusiastic in the beginning, *it soon became evident that the relief of obstructive symptoms was not proportional to the apparent change in the prostate. In very few cases in which complete retention or a large residual was present was there any relief of obstructive symptoms.* In many of the cases in which the amount of residual decreased or the retention was relieved, the results could frequently be attributed to the use of an intermittent or retention catheter, or to the urethral dilation which the application of the radium entailed. Barringer, in several reports which he has made concerning his experience with cancer of the prostate, has obtained almost identical results. Because of the failure to relieve

obstruction in these cases of large residual or complete retention, prostatectomy was carried out in a considerable series, and it was possible then to say to what extent the radium had affected the cancer tissue.

In most cases in which a considerable amount of radium had been employed, the cancer tissue showed microscopically a marked change. Over large areas one would find a complete disappearance of epithelial cells, the connective tissue framework still persisting. In other areas the cancer cells appeared to be shrunken and almost unrecognizable, while in blocks made from other points, the cancer tissue was well preserved. In every case operated upon distinct cancer tissue, apparently unchanged, could be found in areas notwithstanding the amount of radiation previously employed.

The failure of radium to secure relief of obstruction when there is complete retention or a large residual urine except in a small percentage of cases will necessitate the employment of other procedures to secure this result. A part of the failure to secure functional results can be attributed to the fact that in a large percentage of cases the carcinoma is associated with hypertrophy, the radium having little or no effect on adenomatous lobes.

The value of a modified perineal prostatectomy in relieving the obstructive symptoms, even in advanced cases of cancer of the prostate, has long been realized in our clinic.

Of the two hundred fifty cases of cancer of the prostate seen in the Urological Clinic up to the year 1915, in one hundred of these perineal prostatectomy was carried out. In 75 per cent of these there was no return of obstruction up to the time of the patient's death, many of these patients living a number of years. Of these one hundred cases, there was an operative mortality of 3 per cent. In seventy cases it has been possible to secure information concerning the duration of life. Sixteen of these lived less than six months, fifteen between six months and a year; twelve between one and two years; ten from two to three years, and seventeen three years or more. Of these seventeen cases, nine lived between three and four years. Of the remaining eight cases, two lived about four and one-half years, two six years, two nine years and two fourteen years.

The average time of closure following operation differs not at all from the time of closure in the benign hypertrophy cases. In seven cases, a fistula persisted up to the time of death. In none of these one hundred cases, in which prostatectomy was carried out, was anything more than relief of obstruction contemplated, and there was no attempt or thought of eradicating the disease. The low mortality and the relief of distressing obstructive symptoms secured by this operation, relief in the majority of cases extending up to the time of death, is a sufficient justification for this operative procedure.

When a patient presents himself with an advanced carcinoma of the prostate, a large residual urine or complete retention, he is prepared for prostatectomy in a manner similar to that used where prostatectomy for benign adenomas is contemplated. The operation is, of course, not advised where there is advanced cachexia or where the condition of the patient is such that a very short period of life is expected. In such cases palliative measures are adopted to secure for the patient as great comfort as possible. In such cases, except in dire necessity, operative procedures are not carried out.

Technique

The patient is placed in an exaggerated lithotomy position and the membraneous urethra exposed according to the technique employed by Young in perineal prostatectomy. In many cases the membranous urethra will be found markedly thickened because of the extension of the cancer to the peri-membranous tissue. The extension adds but slight difficulty to the proper opening of the membranous urethra which is carried out on a sound. The introduction of the tractor will be found difficult in many cases, because of the extreme contraction of the urethra, and its introduction will necessitate frequently marked divulsion of the prostatic urethra, to aid its insertion. A straight tractor such as was devised by Wilder will be found easy of introduction in these cases. Usually the levator muscles and rectum will be found quite adherent to the posterior lobe of the prostate, and an attempt to secure a dissection as is carried out in exposing the

benign prostate, will lead to serious danger of rectal injury. To obviate this complication the following procedure should be employed: The levator muscles are dissected back from a small area at the apex of the prostate and a short "V" shaped incision is made into the prostatic tissue at this point, enabling one to carry back the levator muscle and rectum with a substratum of cancer tissue attached to them. From this exposure of the prostatic cancer, by means of a sharp curet aided by scissors or rongeur, the center of the prostate is removed, usually en morcellement. As the cause of obstruction is usually the contraction of the vesical orifice or formation of lobular carcinomatous masses at the level of the sphincter, extreme care should be employed to remove most of the tissue from this area. The curettage or enucleation should be continued until a widely dilated vesical orifice is obtained. In some cases when the cancer is associated with adenomatous lobes, the interior of the prostate can be enucleated in one piece or in large masses. After the obstruction has been relieved a large tube is introduced into the bladder through the opening in the membranous urethra and apex of the prostate. Hemorrhage is controlled by gauze packed around the tube. Needles containing radium element or emanation are now inserted into the shell of cancer which has been left. Special preference should be given to the neighborhood of the vesical orifice when this is extensively involved. A radiation equivalent to 1000 mgm. hours is usually employed. This amount has not been followed by any marked symptoms of irritation or any evident systemic toxic symptoms. It is of interest to note that the hemorrhage where this technique is employed is rarely severe and easily controllable by slight packing. The hemorrhage on the average is distinctly less than in the cases of benign hypertrophy and the shock connected with the operation carried out by the above technique is no greater than that associated with the ordinary external urethrotomy.

There is a fair-sized series of case in which the growth has advanced to the posterior bladder wall and base of the seminal vesicles, too far for complete extirpation by the radical resection of the neck of the bladder, vesicles and prostate. In a series of

five cases in this group, the writer has carried out a radical operation which consists in complete removal of the prostate and seminal vesicles without the destruction of the internal sphincter (see plates 1 to 8). In these cases it is possible to remove practically all of the cancer except a slight extension on the posterior bladder wall.

In view of the definite action which radium has on cancer of the prostate when used over a long period and in sufficient quantities, it seemed to me possible that after the removal of the main mass of cancer tissue, radium therapy might cause complete disappearance of the small areas of cancer which would remain behind. In this small series, after complete removal of the prostate and seminal vesicles, radium was placed in position back of the bladder and beneath the vesical orifice, a total of 600 to 1000 mgm. hours being given in one application. In none of these cases was there any marked irritation produced by the radium. Of these five cases, two died within a year of metastases, one had a local recurrence, and two are living and well for a period of three years. These two cases, on rectal examination, show no evidence of carcinoma.

Results obtained by a comparatively radical operation, combined with radium therapy, would seem to indicate the possibility of radical cure in a larger number of cases than could be accomplished by any operative procedure alone.

Summary

The results obtained in the treatment of cancer of the prostate by various procedures or combination of procedures would seem to indicate the following:

Where the cancer is localized in the prostate and has not invaded the posterior bladder wall and seminal vesicles, the radical operation advised by Young is definitely indicated, provided the age of the patient is not too great or there are not present other contra-indications rendering a radical operation extremely dangerous. Where complete extirpation can be accomplished, a large percentage of ultimate cures can be anticipated, as, at this stage of the disease, metastases rarely occur.

The operation, however, will not have a wide application until earlier cases of cancer are seen by the surgeon. Where the malignancy is confined to one lobe and has not invaded the posterior bladder wall, but is well confined to the prostate, complete extirpation of the lobe or lobes, including the capsule, has resulted in permanent cure in six cases in which this procedure was carried out.

The technique of complete extirpation is very little, if any, more difficult than the ordinary perineal prostatectomy. *In the series of cases in which marked obstruction or complete retention is present, the functional results obtained by radium therapy have been disappointing notwithstanding the marked change which frequently occurs in the prostate and vesicles.* In practically all of these cases, the disease is so far advanced that we can hope for nothing except relief of symptoms, and radium alone apparently does not accomplish this in a sufficiently large percentage to warrant the employment of radium alone. Where marked obstruction or retention is present, a conservative perineal prostatectomy gives excellent functional results with a very low mortality. If carried out with the technique described above, the procedure will not be found difficult, nor will it be attended by any serious complications such as recto-urethral fistula, etc. Closure of the wound will be almost as rapid as following a simple urethrotomy.

At the time of operation, after sufficient tissue has been removed to relieve the obstruction, radium needles are inserted into the cancerous tissue. After the closure of the wound, the patient receives a series of radium treatments with the idea of delaying a subsequent development of obstruction.

In about 50 per cent of cases, operative procedures will be unnecessary as little or no obstruction to urination is present. Radium probably will prove extremely valuable in this group of cases, not so much for the cure of the cancer as in preventing the development of urinary obstruction later. In practically all of our cases in which slight or no obstruction was present when the patient was first seen and in whom radium was employed, no serious obstruction later developed during the life of the patient.

While radium has not accomplished all that was hoped for in the cure of cancer of the prostate, it still has a very definite field of usefulness. Its chief field of application will apparently prove to be in that group of cases which have advanced cancer without urinary obstruction in helping to prevent the development of urinary obstruction with its attending distressing symptoms. Radium cannot be considered as replacing operative procedures but in many cases serving only as a valuable adjunct in the treatment of cancer of the prostate. Obviously the application of radium to the prostate can have no influence on the pains due to metastasis.

PART II

The introduction of the cystoscope, making possible the early diagnosis of bladder tumors, has enabled the surgeon to attempt their excision. Until the cystoscope began to be employed there was no diagnosis of bladder tumor made in the Johns Hopkins Hospital except where a suprapubic cystotomy was done because of intolerable bladder symptoms, the operator not infrequently finding a bladder filled with cancer.

With the possibility of early diagnosis with the aid of the cystoscope, the surgeon began to direct his attention to the destruction or excision of these vesical neoplasms. At first, through a suprapubic exposure of the bladder the removal of these tumors was accomplished principally by means of clamp and cautery or by destruction with the cautery alone. A favorite measure was to place a clamp across the pedunculated tumor and then with the cautery blade cut across the pedicle. The more extensive infiltrating growths were cauterized with varying degrees of intensity. The surgeon soon found, however, that practically no results were obtained where the growths were infiltrating and extensive, and that notwithstanding his greatest care in the removal of the more pedunculated and localized growths, he almost invariably, or at least in the vast majority of instances, had to contend with subsequent recurrences. It was frequently noted that where originally there had been only one tumor, the surgeon subsequently found the bladder studded with recurrent

growths, and not infrequently the suprapubic tract itself became the seat of implanted tumor. Sometimes a second and third suprapubic excision was carried out, but the end result was always the same and each succeeding operation found conditions worse.

In 1909 in the symposium before the International Congress, the vast majority of surgeons had about come to the conclusion that patients, as a rule, live longer without operation; that operation was only advisable where there was a definite carcinoma which could be resected, and that only in such cases should surgery be attempted. The results obtained by most surgeons were so discouraging that very few recommended operation with any degree of enthusiasm. The surgeon had no difficulty in thoroughly and effectively destroying the pedunculated papillary tumor. He could not prevent however its recurrence, and when this resulted, he had no means other than surgery to remove it.

While removal of the superficial or pedunculated papillary tumors could be successfully carried out by means of the cautery, it soon became evident that this was not an efficient means of removing infiltrating growths. In the infiltrating type of tumor the radical removal of the area of bladder wall involved was the only treatment which was followed by satisfactory results. It was the common experience of the surgeon that when he resected for malignant growths, this procedure being more or less limited to definite cases of cancer, local recurrences were less frequent than in those cases in which comparatively benign and seemingly innocent tumors had been destroyed by the cautery. This has been our experience. This difference of opinion was so striking that some surgeons boldly advocated that resection, where at all possible, should be carried out in every case of vesical tumors.

While surgeons were obtaining such poor end results, Nitze, by means of his ingenious operating cystocsope was securing results incomparably superior to anything that surgery had up to that time accomplished. He first secured pieces of tumor for microscopic examination, and if the tissue proved to be cancerous, he did not attempt its removal endovesically. If, however,

the tumor was not cancerous, he removed it by this means. The percentage of tumors which he was able to remove through his operating cystoscope and his end results compare almost identically with results obtained by the methods employed today. Apparently the type of tumor which we can today remove by means of fulguration he succeeded in destroying by means of his ingenious cauteries and wire snares. With the introduction of fulguration by Beer in 1910 a new era in the treatment of bladder tumors was begun. The excellent results obtained in certain tumors and failure of the treatment in others led to very careful histologic studies and it soon became evident that fulguration was only effective in benign and malignant papilloma and that it failed to remove the true papillary or infiltrating carcinoma.

In a study made some years ago, we were able to show a recurrence in 40 per cent of the cases within a period of three years. In all these cases the primary tumor had been completely and entirely removed by means of fulguration. The great majority of the recurrences were observed within the first year. In thirty-one of our cases in which papillary tumors had been removed by suprapubic cauterization, recurrences were noted in twenty-five; of the six remaining cases, no recurrence was present in six months in two; one was well two years; one three years; one five years and one ten years. The patient who was free of recurrence for ten years developed, some months later, a small papilloma on the right lateral wall which responded promptly to fulguration. He had no recurrence two years later. It can be seen from these figures that recurrence following removal by means of fulguration is distinctly less frequent than following suprapubic removal of the same type of tumor. Furthermore, it has been our experience that where the primary tumor has been removed by means of fulguration, the recurrent tumor, if seen early, will respond to this treatment. The results obtained by fulguration in the tumors suitable for this form of treatment are really so encouraging that little more can be expected, and the results are incomparably superior to any result which can be obtained by operative procedure. About 40 per cent of all cases of bladder

tumor presenting themselves in our clinic belong to the benign or malignant type suitable for fulguration. This, it is apparent, leaves a great many tumors unsuitable for this form of therapy.

Radium

In 1915 we began the use of radium in the treatment of bladder tumors. Practically all tumors, whether papilloma or carcinoma, were subjected to radium therpy. It was soon found that all of the papillomata responded to radiation and disappeared with varying amounts of treatment, depending upon the size of the tumor.

Technique

By means of a special cystoscope 100 milligrams of radium were carried into the bladder which was previously distended with fluid, and then under direct vision the radium was placed against the tumor mass. It was usually left in position for one hour and the treatment was repeated about every second or third day. The frequency and the period of duration of any one treatment naturally varied somewhat with the tolerance of the individual. This accurate placing of the radium against the tumor mass is very essential, because to effect the tumor favorably and cause its disappearance, frequently required more radium than would ordinarily be sufficient to produce a severe burn of the normal bladder mucosa. This can largely be avoided by accurately placing the radium directly against the tumor and keeping the normal bladder wall distant by means of a quantity of fluid in the bladder cavity. We have in some instances given 2000 to 3000 mgm. hours to infiltrating growths without seriously affecting the surrounding bladder mucosa.

Early in our work, it was found that some papillary tumors which seemed extremely resistant to fulguration treatment, responded very promptly after a small amount of radiation. Consequently, it has been a habit in our clinic to radiate most tumors, even those which subsequently will be treated by fulguration.

Radium has been employed in the past six years in our clinic in 150 cases of bladder tumor, either alone, in combination with fulguration or operation. It has been found that radium will destroy all papillary tumors which will be affected by fulguration. It is rather interesting to note that in one case with multiple tumors on the trigone, most of which disappeared under intensive radiation, one seemed to be resistant, and withstood enormous doses of radium over a period of many months. This tumor, although apparently withstanding intensive radium treatment, when subsequently fulgurated, responded most promptly and disappeared as quickly as the ordinary benign papilloma. We have no explanation of this peculiar resistance.

Our results with radium in the treatment of extensive infiltrating carcinomas have been most discouraging. Although in many instances, many hundred milligram hours of radium application were given directly over the tumor area, in no instance was the tumor, which was distinctly infiltrating, cured by radium therapy. Ofttimes, very malignant looking tumors, which were apparently only slightly infiltrating have disappeared under the radium action.

About 50 per cent of all tumors occur in the region of the ureteral orifices where infiltration, if present can be detected by rectal palpation. In not a single instance in which a tumor associated with induration, which could be detected on palpation, has there been a disappearance of the tumor or a cure of the tumor effected.

During the past six months, following the suggestion of Barringer, in cases in which resection is not feasible, we have been opening the bladder and implanting emanation tubes deeply in the tumor tissue. So far, our results have been discouraging. It is only fair to say, however, that all of these cases in which this form of therapy was adopted were very extensive. In no case so far, in which we failed to effect the cure of tumor by intensive surface application to the tumor area, have we succeeded in curing it by infiltration with emanation or multiple radium needles. Our experience, however, is too limited to draw any positive conclusions regarding the benefit to be derived from this

procedure. Although radium in our hands fails to effect a cure in the extensive infiltrating growths, there is a large group of papillary carcinoma in which only superficial infiltration is present, which are satisfactorily handled with radium. Frequently these tumors are multiple or creep superficially along the mucous membrane surface spreading over large areas. This is a group of tumors which will not respond to fulguration and are mostly inoperable. When the bladder is opened suprapubically in this type of case and an attempt made to destroy the tumor or tumors, recurrence and implantations are most apt to occur. It is in this group of tumors in which radium has given us our most brilliant results—a group of tumors in which fulguration fails and surgery is useless. In these tumor cases it is inadvisable to open the bladder, and we have found it preferable to direct the radium therapy against the surface of the tumor, accurately placing the radium on the tumor surface itself. In this particular group, recurrences are frequent and rapid, and one has to treat frequently recurrences in these cases at short intervals over a period of several years. In one such case, at least fifty tumors were removed during a period of two years. The patient now has had no evidence of recurrence during the past six months.

Tumors anterior to vesical orifice

It has been our experience that tumors in this location should receive surgical treatment, no matter to which group they belong, because it is impossible with any of our present cystoscopes to treat accurately and apply therapy to tumors in this position. In at least three instances we have allowed tumors which apparently in the beginning were comparatively benign, to go on to infiltrating carcinoma before it was discovered that this had occurred. I would recommend very strongly where tumors are partly visible in this position to institute surgical removal. If the tumor is papillomatous, it can be destroyed with the cautery or resection can be carried out. Tumors in this position are not suitable for endovesical treatment and are extremely favorable for operative treatment.

Metastases

It is surprising to what extent tumors of the bladder may progress without the recurrence of metastases. We have been astonished in many cases with extensive malignant tumors of the bladder dying, because of sepsis, renal or some intercurrent disease, to find no demonstrable metastases. In twenty-seven cases of bladder tumor coming to autopsy, in which the growths were extensive and true carcinoma, in only three was the pathologist able to demonstrate metastasis. The slowness and the late date of occurrence of metastases would bespeak an attempt at radical operation, even in very extensive tumors, where it is at all possible to remove the local growth. If the local growth be removed, the prognosis from a metastatic standpoint will apparently be good. In three of our cases the primary tumor disappeared very promptly and rapidly under the influence of fulguration. The patients were seen from time to time and no evidence of re-formation of papillary tumor was noted. One of these patients developed subsequently at the site of the former tumor what was apparently a severe cystitis, the mucous membrane being very red, uneven and in places slightly ulcerated. The other two patients developed similar mucous membrane changes but at a point far removed from the original tumor, in both instances being in the opposite half of the bladder.

Case I. This patient, a male, aged forty-seven, was admitted March 16, 1916, the cystoscopy showing a large papillary tumor back of the right ureteral orifice. This was vigorously fulgurated on three occasions which resulted in a rapid disappearance of the tumor. It was the operator's impression that the tumor belonged to the benign type of papilloma. Subsequent examinations showed the mucous membrane at the site of the former tumor to be quite edematous, very red and somewhat uneven. In August, 1916, five months after the disappearance of the tumor, recurrence was noted behind the right ureteral orifice. This was smooth and there was slight tendency to sloughing. Some edema of the mucosa adjacent to the tumor was also noted. About 200 mgm. hours of radium were applied to the tumor, which disappeared quite rapidly. Examination four months later showed considerable reddening and edema of the mucosa at the site of the recurrence. No tumor,

however, was visible, and rectal examination showed no induration of the bladder wall. The patient was next seen in July, 1917, at which time the edema of the mucosa was still present without any definite tumor being noted. Rectal examination at this time, however, showed a great deal of induration in the region of the right seminal vesicle and the base of the prostate.

Case 2. Patient, male, aged fifty-five, was first seen in March, 1916. Cystoscopy showed an irregular papillary tumor back of the left ureter. This was fulgurated and rapidily disappeared. Examination seven months later showed the region of the bladder occupied by the original tumor to be normal. Back of the right ureter there was noted a localized area about 2 cm. in diameter in which the mucosa was red, edematous and uneven. There was no evidence of tumor. The area gradually increased in size and it finally became apparent that there was present a carcinoma in the bladder wall beneath the mucosa, there being no projecting tumor. Although radium was applied directly to the area the spread of the disease was not controlled and the entire bladder wall gradually became involved.

Case 3. Patient, male, aged forty-four, was first seen in November, 1914, complaining of frequency and burning on urination. On cystoscopy there was found in the region of the left ureter three papillomatous masses, the largest being about 3 cm. in diameter. External to the right ureter the mucosa was extremely red and slightly elevated, This was thought to be an area of localized cystitis. The tumors around the left ureter were fulgurated and promptly disappeared. Three months later the area had increased considerably in size. A rongeur specimen obtained from this area showed superficially a chronic inflammatory process, while the deeper part of the section was typical cancer. Radium applications were made to this area without checking the spread of the disease, the entire bladder gradually becoming involved.

The last two cases cited would seen to indicate that it is possible for metastasis to occur in the bladder wall at some distance from the primary tumor as well as immediately beneath the tumor. There seems no plausible explanation of the carcinoma beneath an infected mucosa unless we admit that this represents a metastasis.

An observation, similar to the three cases cited above, has been made in a case treated with radium. A large papillary tumor

back of the left ureter disappeared under application of radium. A few months later, at the site of the original tumor, there was noted some reddening and ulceration which was at first thought to be a radium reaction. It was subsequently discovered that this apparent radium burn was really an infiltrating tumor of the bladder wall, presenting a picture similar to the cases cited above. These cases represent a metastasis to the bladder wall. While many cases of very extensive cancer of the bladder occur without there being present demonstrated metastases, in occasional instances very small pedunculated papillomata may result in metastases. In three of our cases in which small papillary tumors were destroyed by fulguration, and in which no recurrence of the tumor was noted in the bladder, bone metastases subsequently developed. One metastased to the femur, one to the clavicle, one to the spine. In a limited number of cases it seems that the tumor may metastasize to the bladder wall itself.

Buerger has reported a case in which an apparently innocent pedunculated tumor removed by resection showed in the bladder wall metastatic cancer cells. A similar case has been observed by us. This patient, a man aged 50, had a large papillary tumor on the left postero-lateral wall just back of the trigone. Histologically the tumor was a definitely malignant papilloma, and there was no evidence cystoscopically of infiltration of the bladder wall. The tumor disappeared under a series of radium treatments, leaving a slight reddening and irritation of the mucosa at the site of the former tumor. About two months after the tumor had disappeared, the patient was killed in an automobile accident. Autopsy revealed a normal bladder with the exception of slight ulceration and reddening at the site of the former tumor, evidently the effect of the radium. There was no visible evidence of tumor. Histological sections made from this area showed a superficial zone of inflammation but no surface tumor. In the muscular layer, however, there was discovered a small nest of typical cancer cells, which was undoubtedly metastasis, there being no other evidence of tumor.

Summary

Fulguration should be the method of choice in all benign and malignant papillomata which can be reached by endovesical means. Where the tumors are resistant to fulguration or are papillary carcinoma, non-infiltrating or superficially infiltrating, radium will give uniformly good results, and the results will be obtained by surface applications to the tumors. Where the tumors are deeply and distinctly infiltrating but sufficiently localized so that resection could be carried out and the growth removed with a definite healthy margin of tissue, this procedure should be employed and radium therapy not depended upon. Where, following the removal of the growth, the operator feels that possibly he has not given sufficient margin at any one point, radium should be inserted in the contiguous tissue. In the very extensive cases of carcinoma in which it is impossible to satisfactorily carry out endovesical treatment with radium, it is our custom now to open the bladder suprapubically, destroy as much as possible of the tumor or tumors with the actual cautery, and then implant radium emanation tubes approximately at 1 to 2 cm. distant from each other. What is to be expected from radium applied in this way in these perfectly hopeless cases it is too soon to pass judgment. So far, our results in these otherwise hopeless cases have not been very brilliant.

PLATE 1

The prostate has been exposed and the membranous urethra opened. The urethra is now divided, the dotted line indicating the line of incision on the anterior urethral wall.

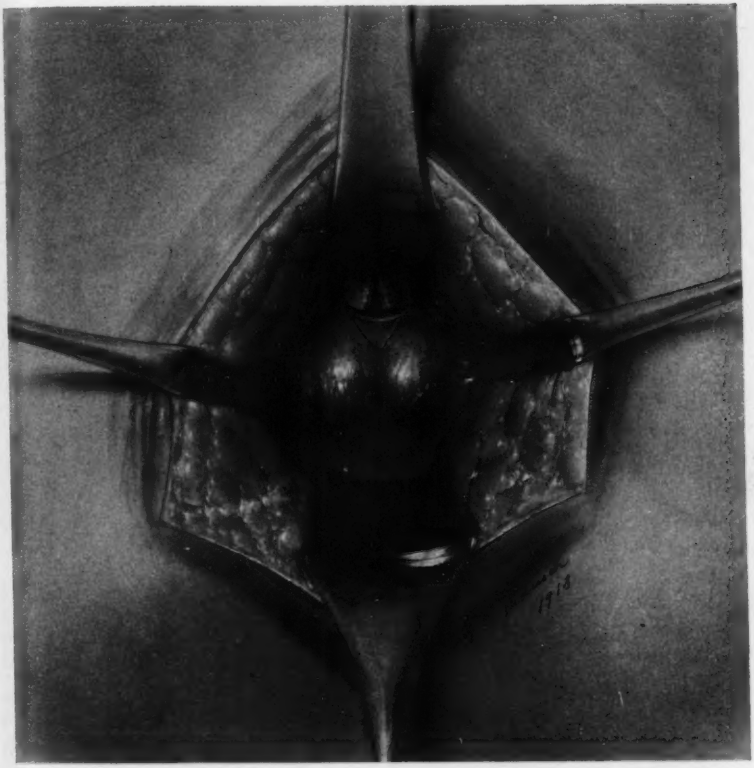

PLATE 2

A cross section of plate 1. The dotted line indicates the line of excision of the prostate and seminal vesicles.

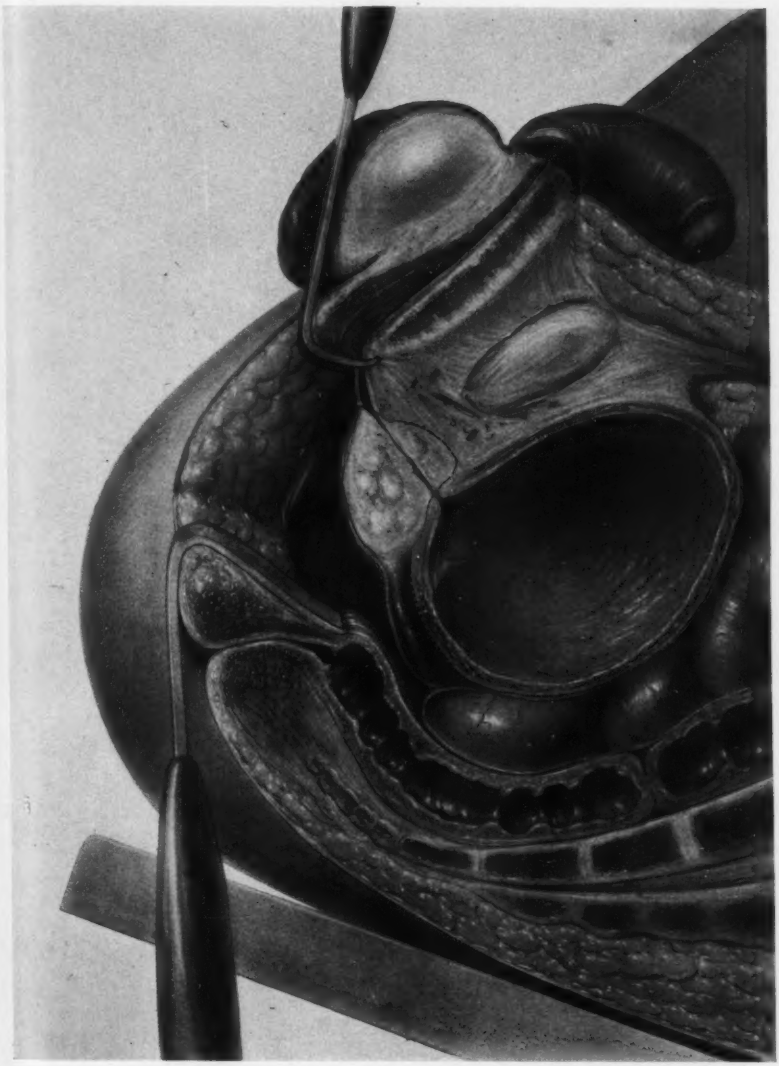

PLATE 3

The urethra has been divided, the prostate drawn downward and the freeing of the anterior surface of the prostate begun.

PLATE 4

The prostate is pulled downward and its anterior surface freed up to the point of its attachment to the bladder wall.

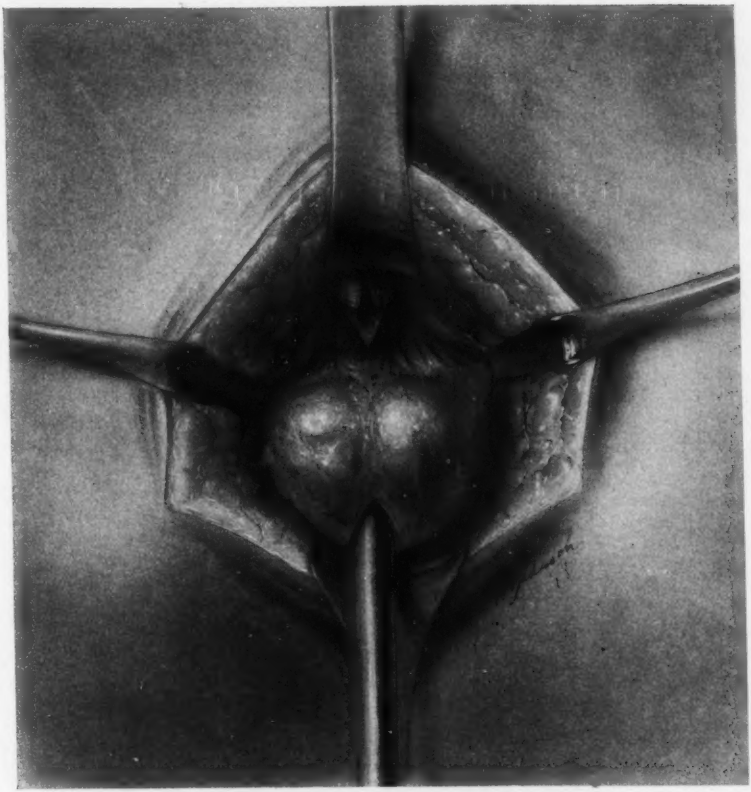

PLATE 5

The prostate has been separated from the bladder, this being easily accomplished. The anterior commissure has been divided and the prostate freed from the tractor. In this instance the vesicles and vas are not removed.

PLATE 6

Showing complete prostatectomy with seminal vesiculectomy.

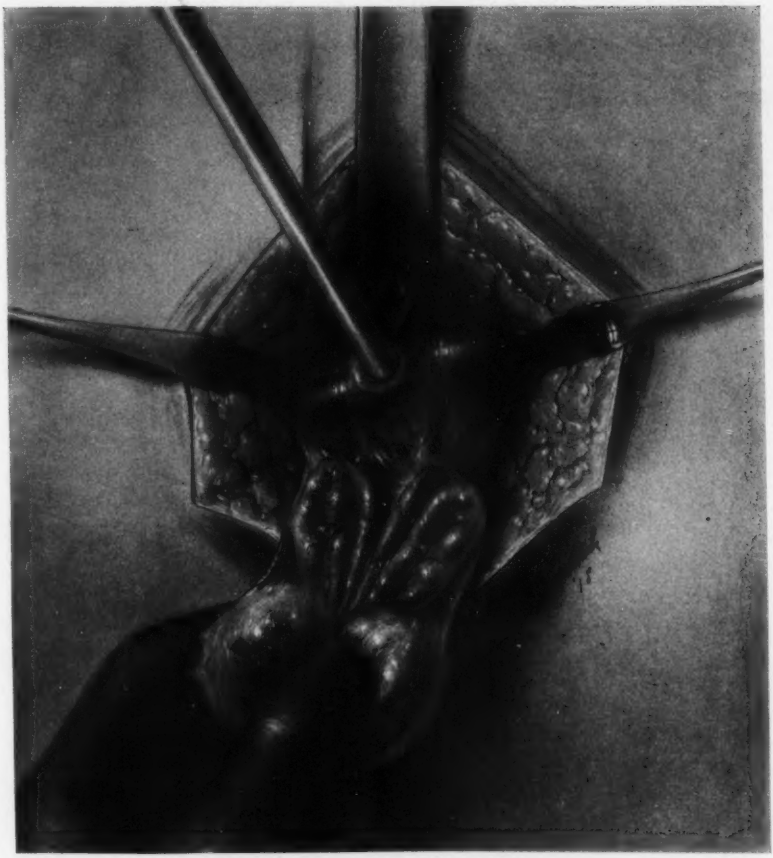

PLATE 7

Cross section showing end of divided urethra. The prostate and seminal vesicles have been completely removed, leaving the internal sphincter intact.

RADICAL TREATMENT OF CANCER OF THE BLADDER

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In no field of genito-urinary surgery are the results more disheartening than those which follow operations for carcinoma of the bladder. Gardner (1) in 1915 analyzed 666 cases of vesical cancer operated upon by various surgeons. In 224 cases of partial resection, recurrence developed in 43.7 per cent; in 442 cases of excision of growth only, recurrence developed in 88 per cent.

The strong probability of recurrence makes it imperative that every cancer of the bladder in which partial cystectomy is possible should be excised by a wide margin, while every effort is made to avoid implantation of tumor cells during the manipulation. Squier (2), in 1914, and Beer (3) in 1921 have described the technic of this operation so well that further elaboration is unnecessary. The chief points in their technic, however, may well be emphasized. They are: First a long incision, allowing for wide retraction; second, mobilization of the bladder, enabling its partial delivery; third, cauterization of the tumor surface as soon as the bladder is opened; fourth, excision of the tumor with the cautery and the searing of all raw surfaces; fifth, bathing the wound in alcohol. Unless the operator is prepared to follow out this technic, he had better not touch the patient, lest the final state of the patient be worse than the first.

Many cases of tumor of the bladder are so extensive when first seen that the removal of the growth by partial cystectomy is out of the question. In other cases recurrences spring up in several sections of the bladder at once. For such cases, various

methods of treatment have been devised. The time-honored operation of curettage followed by cauterization of the entire bladder surface, while frankly palliative, has not infrequently given months of relief. In cases with metastasis elsewhere, this operation may well be considered. The bladder, through removal of masses of necrotic tissue and through the salutary effects of free drainage, ceases to be a cess-pool of putrefaction, and the patient is made vastly more comfortable thereby. In most cases it will not be long before the growth occludes the ureters, causing anuria.

The use of radium in cancer of the bladder of a really inoperable type is a therapeutic measure frequently suggested by those unfamiliar with the subject. Of the 24 cases of cancer of the bladder treated at the Huntington Memorial Hospital for Cancer Research during the past four years, almost all were of this type. The application of radium emanation to the interior of the bladder was tried out faithfully. The amount of radiation administered varied from 300 mc.hrs. to 2000 mc.hrs. Nine cases were given 600 mc.hrs. or more; of those 3 showed a definite retrogression of the growth; several showed temporary cessation of hemorrhage and a diminution of cystitis. The rest were apparently uninfluenced, except that some of them were made much more uncomfortable by the local reaction to radiation.

A similar view as to the ineffectiveness of radium in advanced cases of cancer of the bladder is held by Schmitz (4).

As a result of our experience at the Huntington Hospital we have come to the conclusion that the only really effective way to apply radium in cancer of the bladder is by the implantation of bare emanation tubes or of needles directly into the base of the growth. This may be done by inserting the "seeds" or the needles through the bladder wall under view of the cystoscope, either suprapubically in men or through the vesico vaginal septum in women, by implanting them through the endoscope or by opening the bladder and implanting them directly into the tumor. These methods may be used in the case of small multiple growths which are too widely separated for partial cystectomy; they are unsuitable for large areas of malignant disease.

If partial cystectomy or the use of radium does not offer reasonable chances of success, it is my belief that the urinary stream should be diverted and the bladder opened and treated extensively with radium or removed entirely.

Total cystectomy for carcinoma was first done by Bardenheuer in 1887 (11). In 1910, Albarran collected a series of 40 cases. He advised the combined suprapubic and perineal routes. Wilms in 1912 performed a cystectomy by the pararectal approach.

The indications for total cystectomy are considered by Verhoogen and de Graeuve to be, carcinoma involving the bladder neck or the region of the ureters; malignant growths of the walls or roof, too extensive for partial cystectomy; recurrence of malignant tumors; benign papillomata too extensive or too rapidly recurrent to be removed in other ways; tumors of neighboring organs that have destroyed part of the bladder.

The crux of the whole question is the diversion of the urine. A monograph might be written on the experimental and clinical experiences of various observers along this line. In this paper I can do no more than comment briefly upon the different methods.

Without doubt lumbar nephrostomy is the safest method. This method was advocated by Watson (5) in 1905. At that time he reported his famous case of cystectomy with lumbar drainage, a man who at last report (1919) had lived for sixteen years without a bladder. If tubes are kept in the pelves of the kidneys, infection amounts to very little. The kidney will function for years. The operation is neither difficult nor dangerous. In 3 cases, one of cancer of the bladder, 2 of accidental ligation of the ureters, I have nephrostomized both kidneys at the same operation. The great drawback to the operation is the care which the drainage tubes require, and the aversion which most people have to such a condition. Many say that they would prefer to die.

Ureterostomy, while it has the same disadvantages from the patient's point of view, has the added disadvantages of inadequate drainage. The orifices tend to contract, nor can urine be carried off by a tube as neatly as it can be in a nephrostomy.

Uretero enterostomy, if it can be done successfully, is vastly more satisfactory to the patient. This operation was first done in 1851 by Simon (6), for exstrophy of the bladder; in 1879 Thomas Smith implanted both ureters into the colon extraperitoneally; in 1891, Kuester of Marburg resected the bladder for carcinoma and implanted both ureters into the intestine. All 3 cases were fatal. Chaput (7) in 1892 transplanted one ureter into the rectum for uretero-vaginal fistula, the patient living nine years.

Since that time the operation has been done successfully a number of times, chiefly for exstrophy. C. H. Mayo (7) in 1919 reported 26 cases, 4 of which died soon after operation. Buchanan (8) has collected the late results in 98 cases of uretero enterostomy.

The three dangers are first, general peritonitis, second, ascending infection of the kidneys, third, cicatrical closure of the ureter. General peritonitis may be avoided by making the anastomosis extraperitoneal, as is done by Judd (7). You are familiar with the work of Sweet and Stewart, who in 1914 showed that ascending infection took place by way of the lymphatics. That infection and contraction occur whenever the ureter is put directly through the intestinal wall, but not when a so-called "physiological implantation" is made, was demonstrated upon dogs by Coffey (9) in 1911. Coffey's method has been followed by the Mayos. Lower (10) employs it. The technic in brief, as you will remember, consists in splitting the serosa and the muscularis along one of the taenia coli for a distance of one inch. The cut end of the ureter is bevelled and a stitch fastened to the tip. The intestinal mucosa is then punctured at the lower end of the incision through the other two coats, and the ureter drawn into the lumen of the gut by the stitch which has been carried into the lumen and out through the wall a quarter of an inch below the incision. The muscularis and serosa are then closed over the ureter. By this method a valve is formed. Coffey performed this operation on 9 dogs, 4 of which died. Of the 5 which lived, the kidneys were found good and the valves competent when the dogs were killed, two months to five one-half months after operation.

In the series of 98 cases of uretero enterostomy collected by Buchanan (8), all done before Coffey published his technic, 11 died of ascending renal infection, 2 of pre-existing renal disease, 7 of causes other than renal, 2 of causes unknown, 11 were not traced, 1 reported with polyuria; 64 were well at last report; 13 within one year after operation, 26 between one and three years; 10 between three and six years; 15 between six and twelve years after operation. In practically all there was perfect continence, and they were able to hold the urine between three and six hours. Buchanan preferred the method of Bergenhem, in which the ureters were implanted into the rectum extraperitoneally. This method would not seem feasible in cases of cancer of the bladder, because of the danger of ureteral obstruction from scar tissue in the pelvis.

My own experiences with diversion of the urine have been limited and far from brilliant. In 1917 bilateral nephrostomy followed by total cystectomy was done on a patient at the Massachusetts General Hospital. He had a rather limited carcinoma of the bladder, so situated upon the trigone that resection seemed impossible. This man died January 16, 1920. The cause of death was recorded as carcinoma of abdominal viscera. The objection offered by patients to lumbar drainage, and the fact that most of those who came under my care were obliged to work for a living, induced me to seek some other method of draining the kidneys. A case in which I did a cystectomy and implantation of ureters into the rectum at one operation died of shock. Within the past year I have done uretero enterostomy in four patients at the Huntington Hospital.

Case 1. A. R. Age fifty, advanced carcinoma of the bladder which did not yield to radiation.

May 27, 1920. Operation; median suprapubic incision, peritoneum opened. Bladder feels rather firm and size of tennis ball. No extension of the growth through the bladder wall. No glands felt. Peritoneum incised over each ureter. Ureters cut and tied close to bladder. Right ureter was dilated to diameter of 1.5 cm. Left about one-half as large. Both show evidence of back pressure. Loop of sigmoid brought across abdomen just in front of bifurcation of aorta. Both

ureters implanted in same way about two inches apart. Linen suture tied to bevelled end of ureter. Gut incised sufficiently to allow ureter to enter. Suture on ureter passed into gut and out again a half inch from incision. Wall of intestine approximated over ureter with interrupted linen sutures for distance of ¾ inch. Considerable urine, apparently uninfected, was spilt, so peritoneum was drained with two rubber tissue wicks.

May 29, 1920. After intramuscular pituitrin patient passed about a pint and a half of mixed urine and fecal material. Much distension.

June 1, 1920. It seemed that patient had intestinal obstruction so the abdomen was opened and a knuckle of small intestine was found adherent to the anastomosis. No peritonitis. Obstruction freed.

June 5. Blood urea nitrogen which had been down to 20 mgm. per 100 cc. was 51 mgm. per 100 cc.

June 6. Patient went into collapse and died. No autopsy obtainable.

Case 2. H. Age forty-seven, advanced carcinoma of bladder. Bladder palpable above pubes. Hard and size of hen's egg.

June 7, 1920. Operation: median suprapubic incision; bladder much indurated, especially in anterior wall. A chain of enlarged, bean-sized glands felt along each iliac. Peritoneum incised over right ureter which was normal in size. Divided close to bladder. Left ureter found through same incision; markedly dilated; also cut and tied. Both ureters implanted into loop of sigmoid as in preceding case. Soft rubber catheter was passed up right ureter and out through rectum. I believe this was a mistake. Left in two days.

June 8. Patient has begun to leak clear urine through abdominal incision.

July 17. Leakage having continued each ureter was explored through oblique incision in loin. Left side, incision made above anterior superior spine; ureter found extraperitoneally, apparently normal and not dilated. Ureter incised. Bougie no. 12 passed easily through anastomosis. Blue solution injected which did not come through sinus. Incision in ureter closed and wound closed with drainage. Slightly higher incision on right. Ureter identified and found to be markedly thickened and somewhat dilated. Opened and boric blue injected. Color appears promptly through abdominal sinus. Ureter cut off as low as possible and reimplanted in ascending colon by Stiles' technic. Anastomosis was extraperitoneal. Right anastomosis did not hold.

August 20. Right nephrostomy was done. This has worked successfully and patient has been passing that part of the urine secreted by left kidney, by rectum. Voids every three or four hours.

June 29. He had 440 mc. hrs. applied to bladder through urethra. February 4, 1921, 1008 mc. hrs. to bladder through the suprapubic sinus which followed the incision of a large abscess of space of Retzius.

April 21, 1921. The patient is still living but is very weak. Several sinuses have opened up suprapubically.

Case 3. P. W. Age sixty-three, advanced carcinoma of bladder. No view could be obtained because of bleeding but infiltration could be felt by rectum.

January 17, 1921. McBurney incision just above right iliac crest. Peritoneum opened and pelvis explored. Bladder felt as a hard mass, the size of a tennis ball. No palpable glands. Peritoneum closed. Ureter identified, slightly dilated. Divided just below brim of pelvis. Peritoneum opened. The appendix presented. The temptation to implant the ureter in the stump of the appendix was too great for the operator and this was done. The day after operation urine began to leak through the wound.

February 3. Owing to the presence of a poorly drained pocket of urine in the wound it seemed advisable to make another attempt to implant the ureter. Ureter was found above the area of infection and appeared to be normal. Ureter implanted into ascending colon by Coffey's method. Anastomosis appeared to be satisfactory.

February 4. Patient seems in very good condition. No urinary leakage. Passing urine by rectum.

February 5. At 4.30 a.m. patient suddenly went into collapse and died in about an hour.

Case 4. G. McB. Age sixty-one, a case seen with Dr. O'Neil.

December 3, 1919. Had a suprapubic cystotomy with cauterization of carcinoma and implantation of radium.

October 22, 1920. In spite of treatment with radium the process in the bladder had progressed so far that uretero enterostomy was advised.

Operation: 5 inch oblique incision just above right iliac crest Muscles split. Peritoneum pushed inwards and ureter identified. Quite dilated. Sectioned at brim of pelvis. Urine was noted to be cloudy. Ascending colon was drawn out through peritoneum and ureter

implanted by Coffey's technic. Patient made excellent recovery. No urinary leakage or signs of toxemia. Did not pass any urine by rectum until six days after operation.

October 29, 1920. Similar operation on left ureter which was also found to be dilated. For three days after operation patient passed practically no fluid by the bowel. Neither wound leaked.

November 5, 1920. Patient's condition was very good and he was passing large quantities of fluid by rectum at frequent intervals. Discharge of broken down blood clot from left incision but no urinary leakage.

November 24, 1920. Both wounds healed. Patient passing a good quantity of urine by rectum and is able to hold it three or four hours. Given 1000 mc. hrs. radium treatment to bladder. Discharged November 24, 1920.

After going home patient soon began to fail. He had much pain in back and legs. About March 5 he began to have fever and signs of uremia. Lost control of rectum and the quantity of urine which had been satisfactory diminished. Numerous enlarged glands were palpable in the abdomen especially along the iliacs. He died March 16, 1921. I wrote his doctor asking him whether the uretero colostomy was in his opinion a satisfactory procedure. He answered that it was not.

My experience in these four cases has shown me that the implantation of ureters within the bony pelvis is a technically difficult procedure. In exstrophy of the bladder, in which the ureters already extend to the anterior abdominal wall, this operation may be more easily done. In the cases quoted above, the limited amount of ureter available, and the possibility of kinking the ureter at the point where it issued from the peritoneum, made anastomosis a difficult and uncertain procedure. A much better method is to operate upon one ureter at a time, through an incision just above the anterior superior spine. A loop of colon can be drawn out through an incision in the peritoneum and the anastomosis made extraperitoneal. The technic of Coffey is preferable to that of Stiles.

All of these cases were too far advanced even for total cystectomy. The two who lived were made much more comfortable, although one may well ask, why prolong a life of invalidism?

So far as the kidney drainage is concerned, I feel that they were encouraging. If cystectomy had been possible, a much better result might have been obtained.

Given a case of carcinoma of the bladder in which partial cystectomy cannot be employed with any expectation of success, the possible alternatives are (1) doing nothing. This course should not be followed, because, in an occasional case, operation does give a remarkable and unexpectedly good result, and, in the great majority of cases, the right operation gives relief from suffering. (2) Radium treatment. This alone does not suffice, for doses large enough to produce death of the cancer cause necrosis of the bladder. (3) Cystotomy and cauterization of the growth. This procedure offers only temporary relief. The best one can hope is that carcinomatosis will cause the death of the patient before his bladder again fills up with cancer. (4) Diversion of the urinary stream, with the application of large doses of radium to the bladder, or total cystectomy. With the diversion of the urine, the suffering caused by the presence of urine in the malignant bladder is done away with entirely. A certain small percentage of cases will be cured. The earlier this operation is done, the more cures there will be.

It is my belief that total cystectomy should be done much more frequently than it is done at present; that cancer of the bladder should be treated in as radical a way as we treat cancer in the breast or the stomach. Many cases now operated upon with the "hope of relief" but without the slightest logical reason for believing that relief will be gained, either should not be operated on at all, or should have diversion of the urinary stream, plus thorough treatment of the bladder with radium, or total cystectomy.

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CARCINOMA OF THE BLADDER WITH BONE METASTASIS

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That malignant tumors of certain organs have a tendency to produce bone metastases is an old and well-recognized clinical fact, and it is generally believed that carcinomata of the prostate, breast and thyroid, as well as the hypernephromata, are the most frequent of the malignant tumors which produce bone metastases.

On the other hand, carcinomata of the uterus and stomach rarely exhibit this phenomenon. To this group may be added carcinomata of the bladder. That this assumption is universally held is justified by the facts that the subject of bone metastasis in carcinoma of the bladder receives little or no attention in the various text books on genito-urinary surgery and that the literature shows but a few isolated case reports.

Moore, in a study of 65 cases of metastatic malignancy of the bones, found the primary growths as follows: Breast 36, prostate 11, kidney 7, thyroid 7, vulva 1, sigmoid 1, uterus 1, abnormal masses of unknown origin 3, and primary source not discovered 3. No case of carcinoma of the bladder producing bone metastasis is found in this series of 65 cases. Geraghty, however, states that bone metastasis is common in cases of carcinoma of the bladder and Zuckerkandl mentions the fact that they do occur.

Recently Woodruff reported a case of bone metastasis following carcinoma of the bladder. Westerkamp has also reported a case belonging to this group.

It may be possible that bone metastasis in bladder carcinoma occurs more frequently than we believe at present and that the bone metastases are overlooked and not recognized.

Several years ago Pfahler called attention to the fact that metastatic carcinoma involving bone is much more frequent than

is generally recognized and probably in the advanced stages occurs in nearly 20 per cent of the cases. His paper contains many references to this subject from the roentgenological standpoint.

Because of the fact that carcinoma of the *prostate* produces metastasis in the bones and because this occurs much more frequently than is generally believed, and because carcinoma of the bladder rarely, or supposedly rarely, produced bone metastases, great care was exercised in excluding from this paper, cases in which the carcinoma might have been primarily in the prostate gland.

In 1854 Sir Henry Thompson reported a case of bone metastasis from a primary growth of the prostate gland. Since the various articles on the subject of bone metastasis in carinoma of the prostate have appeared. Blumer, in 1909, collected 43 cases in his paper, to which he added 2 later cases, and, recently, Bumpus, in reviewing 362 cases of carcinoma of the prostate, was able to find evidences of bone-metastases in 79 or 21 per cent of his series.

It has been stated repeatedly that tumors of the bladder produce metastases late in the course of the disease. Often, metastasis or extension of the tumor outside the bladder is difficult to demonstrate, and because of the assumption thet metastasis occurs late in the course of the disease, extensive radical operations are advised and carried out.

With the above-mentioned statement I wish to disagree. That bone metastases can occur relatively early is illustrated in 3 of the cases in this series in which the cystoscopic examination showed tumors that were relatively small and that from the cystoscopic appearance were ideal cases for wide resections. These 3 cases further demonstrate clearly the necessity for careful roentgen ray studies of all cases of carcinoma of the bladder for the presence or absence of bone metastases before the patient is subjected to an extensive operation, since the uselessness of operating such cases is apparent. The same statement is true if a course of radium treatment is decided upon. Needless to state that the value of this knowledge in giving our prognosis is self-evident. This fact becomes all the more important if we take into consideration the

wave of enthusiasm sweeping over the country in favor of radium treatment.

This paper is based upon a study of 3 clinical cases that have come under my personal observation during the past seventeen months and the autopsy reports of 2 cases kindly placed at my disposal by Dr. Peter Bassoe.

Sex. All these cases occurred in males.

Age. The ages were as follows: Forty-four, forty-four, forty-six, sixty-three and seventy-two.

The 3 clinical cases were the three youngest in the group. All three were under fifty years of age.

SYMPTOMS

Pain was present in each case. An analysis of the pain showed there were two types of pain. Tne first type of pain was the pain incident to the carcinoma and as such was not different from the pain in any case of cancer of the bladder. The pain was associated with urination and was severe, sometimes being described as burning in character. In one case the act of urination was free of pain.

The second type of pain was the pain due to the metastatic involvement of bone, and in these cases, as would be expected, was very severe and excruciating, requiring large doses of morphine to control it. Its severity was in no manner different from the severe pain seen in other forms of bone carcinoma. The pain was localized in the boney structures that showed the metastases and was recorded as follows: back and abdomen; perineum, hip and over pelvis; perineum and upper two-thirds of the thigh and back. In 2 cases it was referred to the testicle.

Hematuria, burning and frequency were present in all the cases. In one case incontinence was mentioned.

CYSTOSCOPY

Cystoscopic data were available in the 3 cases under personal observation. These showed the presence of a single tumor in each instance, located as follows: near the right ureteral orifice, near the left ureteral orifice; and in the apex of the bladder. The tumors varied in size, being describes as the size of a plum; as large as an

almond; and smaller than a twenty-five cent piece. Two of these were described as papillary tumors and one as a carcinoma.

As previously mentioned in this paper, the tumors were all small and so situated thay they would have been ideal cases for wide resection, although in one case this would have meant transplantation of the ureter.

Particular emphasis is being laid upon the fact that these tumors were small at the time the patients first came under observation, illustrating that although the *primary tumor of the bladder may be small, extensive metastases mah be present.* Because of the small size of the tumors and the absence of bladder wall involvement in 2 of the 3 cases, these patients appeared, at first examination, to be very early cases; the tumors favorable ones for resection, and apparently the chances for recovery excellent. A similar condition may be met with in carcinoma of the prostate in which the primary tumor may be very small and yet have produced extensive bone metastases.

ROENTGEN-RAY FINDINGS

The 3 cases under my personal observation were subjected to careful roentgen-ray examination an in all three evidences of bone metastases were present. The metastases were rather extensive in 2 of the 3 cases and apparently out of proportion to the size of the primary growth in the bladder.

The roentgen-ray findings were those of simple massive bone destruction which were seen at intervals to progress by continuity, multiple foci having been observed at various stages of development in various portions of the lower spine and pelves. In 2 cases the pubis and ischium ucre involved. In none of the lesions was there any pronounced sign of new bone development about the lesion, the striking appearance being that of simple irregular bone destruction.

In one case there was evidence of new bone formation as demonstrated in a piece of bone removed at autopsy.

METASTASES

Two types of metastatic carcinoma of the bone are recognized, —osteoclastic and osteoplastic, the osteoclastic leading to bone

destruction. In the osteoplastic new bone formation predominates over bone destruction so that the bones become very hard and dense, which phenomenon can easily be recognized in the roentgenograms. This type of bone metastasis is frequently seen in carcinoma of the prostate. According to Kaufman, the osteoclastic type of metastatic carcinoma occurs more commonly than does osteoplastic. In this series all 5 cases belonged to the osteoclastic type.

Autopsies were performed in 3 of these cases and the metastases were found as follows:

Case II. In the glands in the perivesical fat, and in the bony pelvis.

Case IV. In the bony pelvis, right eight rib, left second and ninth ribs; in the mesenteric, retroperitoneal, inguinal and tracheobronchial glands and in the liver.

Case V. In the eighth rib and in the liver.

Autopsies were not performed in 2 cases and the metastases as determined by the X-rays were as follows:

Case I. In the bony pelvis (see figs. 1 and 2).

Case III. In the spine.

Metastases to the skin are uncommon in this type of tumor. In case I metastases to the skin occurred. A hard nodule was seen in the midaxillary line and this was removed under local anesthesia. Histological examination showed the presence of carcinoma.

HISTOLOGICAL EXAMINATION

In 2 of the 3 clinical cases pieces of the tumor were removed with the cystoscopic rongeur and as a result of histological examination a diagnosis of papillary carcinoma was made in each case. In the third case the diagnosis was verified by sections obtained at autopsy.

Case I. A. N., aged forty-six. Referred by Dr. D. E. Murphy and Dr. G. Noger.

Hematuria. First noticed seven months before admission to hospital. No pain or frequency at onset. Passed clots of blood at intervals of a week or so ever since.

Pain. Three months ago began to have pain in perieum. Gradually became worse and patient could not work because of pain which seemed to be located chiefly about rectum. About sixteen days before admission to hospital began to have severe pains aneterior to left hip-joint and in left hip joint, radiating down leg to knee and sometimes below knee. Pain became so severe patient could not sleep.

Frequency. One month before admission patient began to get up nights to urinate and voided every hour during the day.

Rectal examination. Prostate negative; seminal vesicles palpable.

X-ray examination. Urinary organs negative for stone. Bladder outline apparently normal in contour. Bony pelvis showed definite change, involving the horizonal remus of the pubes, the symphysis, the descending ramus of the pubes and ascending ramus of the ischium. The bony structures seemed to be absent, having the appearance of being washed out. No areas of new bone formation seen. Symphysis on the left side seemed to be rough and irregular (figs. 1 and 2).

Cystoscopy. In the apex of bladder a papillary tumor about the size of a large hazelnut, not definitely pedunculated. Piece removed for histological section showed a papillary carcinoma.

Patient noticed a small nodule about the size of an olive in midaxillary line of right side of chest, not painful and apparently not connected with bone. Subcutaneous tumor removed and histological examination showed carcinoma of same appearance as tumor removed from the bladder.

Case II. C. B., aged sixty-three. Referred by Dr. M. Weisskopf.

Hematuria. Hematuria was the first symptom; onset seven months ago was painless; but some weeks before onset had pain in left kidney. Much bleeding for one week, also occasional clots.

Burning in urethra present for three months, gradually increasing in severity, and present during act.

Pain. About three months before admission to hospital pain in the urethra and perieneum which gradually became worse until at time of admission patient had to take opiates and extended to end of glans and present constantly, but worse at night. Pain around coccyx and in inner and upper two-thirds of thigh, which on account of its constancy interferred with walking. Pain, not severe in character, in left groin, seemingly having its origin in a swelling which appeared to be a hernia. Patient complained of a dull ache in the left testicle, which symptom had been present for six weeks and was aggravated by being on his feet.

Frequency. For several years frequency had been present, and at time of admission patient had to void every half hour during the day and six times at night. Stream had lacked force for about six months, and dribbling was present at end of urination.

Loss of weight was 25 pounds in two years.

Rectal examination. Prostate not enlarged or hard, but firm, especially upper pole of left lobe.

X-ray examination. Negative for stone in the urinary tract. There was a very definite osseous defect in the ramus of the left ischium, which consisted of bone destruction to a large extent; a slight disturbance of a definite nature was also seen in the sacrum (figs. 3 and 4.)

Cystoscopy. Left ureteral orifice not seen. Near the internal urethral orifice, a tumor about the size of a twenty-five cent piece.

Patient left the hospital but returned in a few days complaining of a large amount of hemorrhage from the urethra, pain in left thigh, pains in region of bladder on urination and pain on pressure over left sacro-iliac joint, sacrum and left side of sacrum.

Cystoscopy (January 6, 1921). Previously seen tumor much more extensive, reaching to the internal urethral orifice.

Patient died February 7, 1921.

Autopsy. Kidneys, ureters, bladder and prostate removed intact. Glands in the perivesical fat large and palpable; prostate negative (fig. 5); to the left of left ureteral orifice for about ½ inch outward and 2 inches upward, a hard tumor mass, crescentric in shape, covered with mucosa. Center of tumor, necrotic. As the ureter passed the tumor mass, a very distinct stricture was present, and, directly above this, dilatation began.

Case III. O. S., aged forty-four. Referred by Dr. B. N. Parmenter.

Patient complained of pain in the back, burning on urination, frequency, incontinence and hematuria. Pain in back was first noticed three years before coming under observation, was located just above the pubis and passed into the penis, being noticed more after urination. First attack lasted three days; another attack, two years later, lasted one week, and then pain more severe, began in back and radiated to the pubis and into the penis. Another attack, nine days before admission to hospital, with pain which began above crest of ilium in the lumbar region and radiated to the pubis, penis and down the legs on both sides. Attacks lasted from fifteen to thirty minutes and occurred at short intervals.

Physical examination. Negative.

X-ray examination. Negative for stone in bladder, ureters, kidneys or prostate.

Cystoscopy (January 12, 1920). Tumor as large as a plum in region of right ureteral orifice. Piece removed for histological examination showed papillary carcinoma.

Roetgen-rays at this time showed no changes suggestive of bone metastasis, therefore operative treatment was suggested and refused. In lieu of operative treatment patient was treated with radium and bipolar fulguration. A cystoscopic examination July 27, 1920 showed the bladder to be free of tumor although the base was still somewhat edematous. Patient was free of urinary symptoms for three months, after which time he began to complain of severe pain in the back.

Spinal fluid at this time was negative.

Because of the persistence of the severe backache a second roentgen-ray examination was made, November 8, 1920, and Dr. Potter reported to the effect that the plates showed evidences of bone metastasis in the lower part of the body of the fourth lumbar vertebra and on the right side of the first portion of the sacrum. A third examination was made January 5, 1921, which showed evidences of metastasis in the sacrum.

Patient died January 21, 1921. Autopsy was refused.

Case IV. H. K., aged forty-four. Referred by Dr. Peter Bassoe.

Previous operations. Internal urethrotomy twenty years ago.

Previous injuries. Four months ago fell on right hip. Three months later had pain and tenderness of right half of pelvis. Small hard tumor appeared at right sacro iliac joint. Not adherent to skin.

Present complaint. After illness, twenty years ago, patient was well until one year ago. At that time he began to have painful and frequent urination. Urinary condition grew worse after fall on hip. At present voids every ten minutes.

Operation. Tumor the size of an orange removed from bladder, and part of right ilium removed. Patient died twenty-two days later.

Autopsy. Carcinoma of bladder, mesenteric, retroperitoneal, inguinal and tracheobronchial glands, liver, bony pelvis, right eighth rib, left second and ninth ribs. Pathological fracture of left eighth and right second ribs. Ascending cysto-, uretero-, pyelonephritis with dilatation of right ureter and renal pelvis. Bilateral serofibrinous pleuritis. Abscess behind right psoas; septic arthritis of right sacroiliac joint;

sloughing operation wound of back; edema and congestion of lungs; acute splenitis.

Case V. H. M., aged seventy-two. Referred by Dr. Peter Bassoe. Patient complained of pains in back and abdomen, principally on right side, sometimes radiating down right thigh and testicle.

Operation. About one half of bladder wall resected. Patient died six days after operation.

Autopsy. Metastatic carcinoma of liver and right eighth rib; nodular tuberculosis of both lungs; bilateral fibrous pleuritis; anthracosis of lungs and of tracheobronchial lymph glands; sclerosis of aorta; arteriosclerotic atrophy of kidneys; chronic gastritis; acute cystitis and urethritis; localized fibrous pericarditis; fibrous perisplenitis; decubitis of urethra; accessory spleen; patent foramen ovale.

SUMMARY

1. Bone metastases occur beyond a doubt in cases of carcinoma of the bladder.

2. Their occurrence is uncommon as compared to the frequency of bone metastases in carcinoma of the prostate.

3. Extensive metastases may be present although the primary tumor in the bladder be small.

4. Prior to operation or radium treatment, routine examination of the caseous system, by means of roentgen rays, to make certain the presence or absence of metastases should be carried out in all cases of carcinoma of the bladder.

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DISCUSSION

Dr. L. E. SCHMIDT: Certainly in favorable cases of cancer of the bladder resections are to be considered. It is true there are in these types, as well as in all others, frequent recurrences, but this is no reason not to advocate this procedure. I am positive that much relief and prolongation of life has resulted in many instances. Furthermore, I have quite a series of cases where I have operated three or four times for recurrences. In each and every instance I have had no occasion to regret doing so. Naturally in all instances at the present time, radium applications are made at time of operation.

As to advising cystectomy, I am certain that in advanced cases of cancer, it would not be advisable. To do so in real early cases is questionable. Just at present it is still impossible in every instance to select the suitable cases for this procedure I am rather inclined to believe that it does not offer all that enthusiasts expect of it.

SECOND DAY, MAY 3, 1921

OBSERVATIONS ON THE PHYSIOLOGY AND PATHOLOGY OF THE URETER

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Though the function of the kidney in the production of urine, and that of the bladder in expelling it, are still objects of investigation and discussion by both laboratory workers and clinicians, the work done by the ureter in the transmission of urine is much less often considered. This is of course significant of the fact that the problems surrounding the ureter, both in health and disease, are much fewer in number and of less importance than those concerning the two organs which it connects. And still the ureter is by no means devoid of importance.

PHYSIOLOGY

To summarize the present ideas on the physiology of this tube as brought out in the recent papers of Satani (1) in Baltimore, and those of Penfield (2) and O'Conor and Wislocki (3) in Boston, the ureter is a muscular tube which by peristaltic waves propels the urine from the kidney to the bladder. These waves vary in rate according to the varying diuretic activity of the kidney. The waves begin at the renal pelvis and pass downward to the bladder, to end in the opening of the uretero-vesical valve. They are initiated by an area of high metabolic rate in the renal pelvis and pass to one of lower rate below, in a manner quite analogous to intestinal peristalsis. Such an arrangement from a physical point of view is one admirably adapted to create and maintain a very low or even slightly negative pressure in the renal pelvis. For the increase in pressure on the contents of the tube which occurs just ahead of a wave, quickly gives

way to a marked diminution of pressure, just behind one; and this lowering of pressure must act to withdraw more fluid from the calices. At the bladder end these pressure relations are maintained, under the usual physiological conditions, by the competence of the uretero-vesical valve, as an illustration of which fact I need only remind you of the impossibility in the cadaver of increasing the pressure within the bladder to a degree sufficient to propel fluid up the ureters.

In one important respect the ureteral peristalsis seems to differ from that of the intestine in that it does not show a reverse direction, or retroperistalsis. It has been noted, however, by all experimental workers on the ureter, that there occasionally occurs a reflux from the bladder to the kidney pelvis in either one or both ureters. This reflux has most often been seen in rabbits. The possibility of its occurrence in man has been denied by several writers, notably Sampson (4), although it is clearly evident that opportunity for careful study of the phenomenon under physiological conditions in man has been very infrequent. On the other hand Hagner (5) has reported two instances of reflux from the bladder upward around a ureteral catheter, and even more convincing evidence is brought forth by a series of cystograms made by Kretschmer (6) in 1916, in which the uretero-vesical valve was normal and free from the presence of an instrument, but in which, nevertheless, the opaque fluid entered the ureter from the bladder spontaneously. In experimental animals this reflux is found to depend but little on the degree of distension of the bladder, since it takes place at but a few millimeters of pressure as measured by the mercury manometer, and even this amount of intravesical pressure is not a constant one. It does depend directly, however, on the tonus or irritability of the bladder wall at the moment at which the reflux occurs. That it is in no sense a retroperistalsis can easily be determined by measuring the speed of the upward wave which has been estimated to be nearly three times quicker than the rate of an antiperistalsis wave caused by stimulation with barium chloride. As observed in a rabbit whose bladder contains a fluid colored by methylene-blue, it seems as though the bladder

detrusor muscle, being stimulated to contract at the moment the uretero-vesical valve happened to be open, suddenly ejects a column of blue fluid upward into each ureter as far as the kidney pelvis. To quote from the protocols of O'Conor and Wislocki:

While the ureters are under observation a column of blue fluid suddenly fills the lumen of the right ureter. A peristaltic wave which already left the renal pelvis meets the ascending column in the upper half of the ureter and impedes its progress. Fresh peristaltic waves commence above, becoming more frequent and vigorous and a struggle ensues for control of the ureter. The column of fluid advances towards the kidney and recedes again with each peristaltic wave. Gradually the peristaltic waves completely expel the methylene-blue solution from the ureter and the uretero-vesical orifice closes. The peristaltic waves quickly subside and resume their former frequency of one to two per minute. This phenomenon repeats itself in a few minutes on the same side and also in the left ureter.

Occasionally the ureters are unable to expel the invading fluid. The following instance illustrates this occurrence.

Rabbit 4. Male. November 10, 1919. After the initial procedures as described in the preceding experiment have been carried out a column of blue fluid is suddenly seen entering the right ureter. Vigorous peristaltic waves attempt to expel the fluid in the ureter, but after a few minutes it is observed that the ureter is becoming more and more distended with methylene-blue solution while the ureteral contractions are becoming feebler and feebler. Finally, the ureteral movements cease entirely and the invading fluid takes complete possession of the ureter and renal pelvis.

It is immediately evident that if a phenomenon analogous to this reflux should be proved to occur in man, the explanation of many of the problems of renal function as well as of renal infection will be much simplified.

PATHOLOGY

From a pathological viewpoint, the response of the ureter to two sorts of conditions is important; namely to those of obstruction on the one hand, and to infection on the other.

The response to obstruction of the ureter itself in its continuity is well known both experimentally and clinically. If the obstruction be complete the tube dilates to a point consistent with an intrarenal pressure of from 40 to 60 mm. Hg. less than that of the systolic blood pressure, at which point secretion from the kidney stops; and if the obstruction persists the organ slowly atrophies. Ureteral peristalsis is absent from an early date in the process. But if the obstruction be an incomplete or intermittent one, the ureter at first undergoes hypertrophy as well as dilatation, and experimentally the peristaltic waves are seen to be much increased in frequency and force. Under each of these conditions the tube increases in length as well as in size, and thus is produced the tortuous course with "S" shaped turns so familiar at the autopsy table.

Obstruction to the outflow of urine from the bladder, such as is produced by the hypertrophied prostate, congenital valves, or stricture of the urethra, may also be of significance in bringing about changes in the ureter, although the impediment is not located in the tube itself. These changes consist of hypertrophy and dilatation as in the previous case, but occurring at a much later date in the life history of the obstructing cause than where the ureter is itself involved or they may frequently be absent.

The response of the ureter to infection is always shown by dilatation of its lumen and loss of elasticity of its walls. According to the degree of infiltration by inflammatory products the wall may be found thickened to a greater or less degree. For instance, in infection by the tubercle bacillus the ureter is often seen to be eight or ten times larger than normal, but on section this increase in size is seen to consist almost wholly of increase in the thickness of the wall with but moderate increase in the lumen. Non-tubercular infection, on the other hand, may cause an equally large ureter with but little change in the thickness of the wall. It is important to note the fact that such dilatation frequently occurs in the entire absence of any form of mechanical obstruction.

The integrity of the uretero-vesical valve is lost much earlier in the presence of infection than it is in cases of obstruction

only, and it is only in the presence of severe infection that such marked changes as those expressed by the term "golf-hole orifice," are seen.

Clinically, at operation or at autopsy, the alterations found existing in the ureter are most often to be ascribed to the combined effect of both obstruction and infection, and since both

FIG. 1

causes act in a measure to produce similar results it is not always possible to form an accurate judgment as to the individual influence of each. Cases in which only one of these factors has been operative are not rare, however, of which the following may serve as types:

Case 1. Infection only. A single woman of twenty-one years entered the Peter Bent Brigham Hospital February 21, 1920, complaining of backache.

Her general health has never been good. She has suffered from frequent tonsillitis until ten years ago when the tonsils were removed, and also from many headaches associated with nausea and vomiting.

Three years ago she had an attack of pain which was first thought to be appendicitis but, on examination at the Boston City Hospital, both

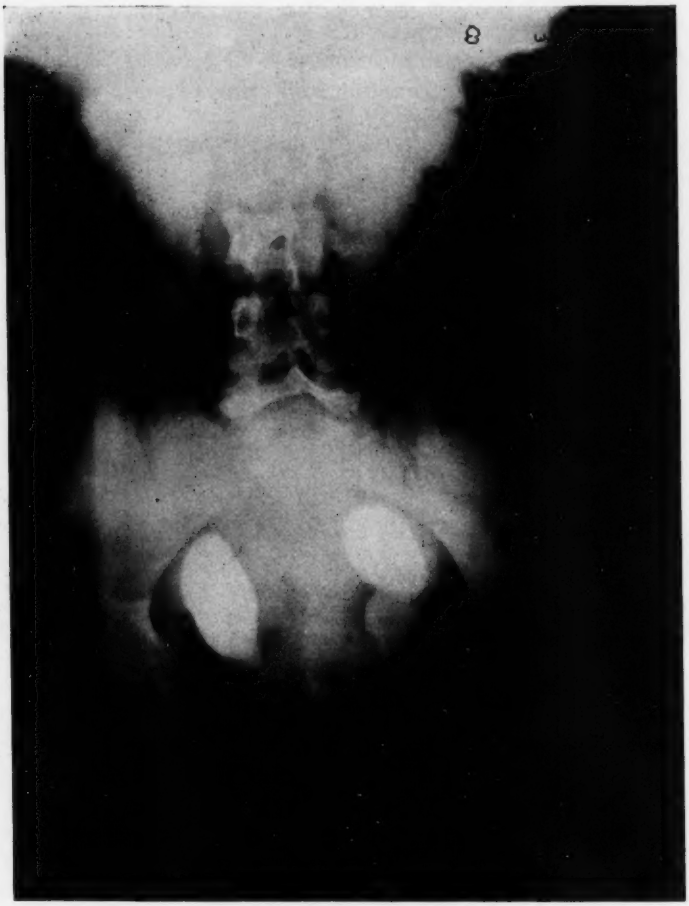

FIG. 2

kidneys were found infected and the ureters seen to be dilated. Though examination of the urine failed to find tubercle bacilli, no further

diagnosis was made. As a child she had dysuria, and she has always had nocturia, two or three times. Since the age of four she has had a "slimy urine," for which she has received medication off and on. Since three years ago she has had pain in the back, especially in the left lumbar region. Eleven months ago she had "influenza," and shortly after this tubercle bacilli were found in the sputum. This was followed by fever and three months later a pleurisy developed.

Examination showed bilateral pulmonary tuberculosis and a turbid urine in which there were no tubercle bacilli on guinea pig inoculation. The phthalein output was only 10 per cent in two hours, and there was a blood urea nitrogen of 57 mgm. in 100 cc.

Here we have a history of chronic infection of the urinary passages extending over years. On filling the bladder with opaque solution by catheter, the fluid entered the enormously dilated ureters readily (figs. 1 and 2).

Case 2. Infection only. A girl of seventeen entered the Peter Bent Brigham Hospital on October 11, 1918, unconscious and with fever. A diagnosis was made of cerebro-spinal meningitis of the epidemic type. Thirty-six days later, after seven or eight injections of antimeningococcus serum, she was discharged cured of all signs of meningitis, but there remained a gangrenous cystitis with deep, extensive ulceration of the bladder. The urine had contained pus since entrance, and on culture showed the colon bacillus.

Examination by cystoscope showed that each ureteral orifice was dilated, and on cystogram fluid passed readily upward into each renal pelvis (fig. 3).

Case 3. Obstruction only. The specimen illustrated here was found at an autopsy made by Dr. S. B. Wolbach at the Children's Hospital, on a baby somewhat less than a year old. There was no sign of infection in the urinary tract, but because of congenital incomplete stricture of each ureter at its entrance into the bladder, very extensive hydroureter and hydronephrosis took place. These results are in all respects analogous to those where an incomplete obstruction is caused experimentally (fig. 4).

THE URETER IN PROSTATIC OBSTRUCTION

These being the general facts of the physiology and pathology of the ureter, it is of interest to consider their especial applica-

tion to the condition of prostatic obstruction. To gain an idea of the clinical condition of the bladder and ureteral orifices in

FIG. 3

such cases, I have reviewed 150 histories of patients examined and operated upon in my clinic at the Peter Bent Brigham Hospital. In the first place it is of interest to find that of this number only

34 were free from infection of the bladder urine on entrance to the hospital. There are notes on the cystoscopic appearances of the ureteral orifices in 29 of this group of uninfected cases, and in all they appeared to function normally and to be free from edema or other distortion. In five instances either it was not possible to see the orifices because of the size of the hypertrophied gland, or cystoscopy was not done.

No further attempt than observation by cystoscope was made to investigate the condition of the ureters in this group of uninfected cases. It may be objected, therefore, that such observation of the uretero-vesical valve is not a sufficiently accurate method to establish its functional integrity, and also that it reveals nothing in regard to the ureter itself. This objection which is sound in a measure at least, I have tried to meet in part by autopsy records of cases with clean but obstructed bladder, who died from causes other than those present in the urinary tract. Such cases are not very common, but the findings in them, as far as I have investigated the question, all bear out the point that in the absence of infection, obstruction by the prostate does not carry as a necessary consequence any abnormality of the ureters. Two such autopsy records are as follows:

Case 4. A man, aged seventy-two entered the Peter Bent Brigham Hospital on March 19, 1921, in an irrational condition, with a high fever due to broncho-pneumonia and lymphangitis of the leg. He had suffered for two years from a varicose ulcer of the leg, with much edema of both legs, for which he was given digitalis in the Medical Out Door Department. At entrance to the hospital it was impossible to get a detailed history because of his mental condition. He was continuously incontinent of urine so that this was not examined.

At autopsy the right kidney weighed 250 grams; the left 190 grams. Their capsule was not adherent. Both pelves and ureters were normal. The bladder was small and contracted, and without any evidence of infection. The prostate formed an enlarged spherical mass 6 cm. in diameter, obstructing the vesical outlet. On microscopic examination the kidneys showed chronic pyelonephritis and arteriosclerosis.

Case 5. A single man, aged seventy-four, entered the Peter Bent Brigham Hospital March 19, 1919, complaining of bronchial trouble,

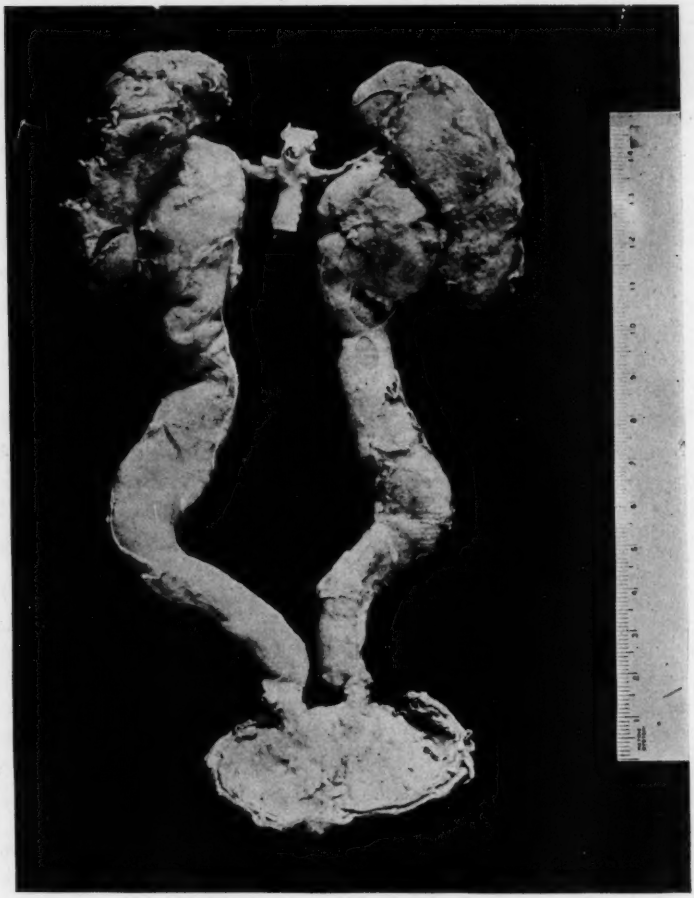

FIG. 4

and died five days later of broncho-pneumonia. For ten years he had had nocturnal frequency, but no retention. The phthalein test showed about 10 per cent. The urine was free from pus.

At autopsy the bladder was distended with about 500 cc. of urine, and the prostate was enlarged in all its lobes, to about 5 cm. in diameter. The ureters were normal in all respects. The kidneys showed chronic nephritis.

We have here then cases illustrative of the fact that an obstruction may be caused by the prostate which is accompanied by extreme degrees of renal damage and still the ureters remain normal. Such evidence leads strongly to the conclusion that whatever may be the fate of the ureter or of its valvular opening after infection has supervened, there is either no change in its histology or at most only moderate hypertrophy in clean cases.

As regards the group of infected cases, evidence also exists that in some of these, too, there is but little change in the ureters. But in other instances of longer duration or of greater severity of infection, profound alteration with dilatation of the tube and destruction of its valvular opening are well known to occur.

In all the many studies on the mechanism of prostatic hypertrophy, one meets frequently with a statement that in such conditions renal function is impaired and permanent pathological changes are brought on by so-called "back pressure" from the bladder to the kidney. It is pointed out that the kidneys are continuously compelled to do their work at a disadvantage, and it is inferred, at least, that this consists in an abnormally high intra-pelvic and intra-ureteral pressure. When there exists obstruction at the outlet of the bladder, this organ must contract more forcefully than is normal at each urination to expel the contents, and the inference is that this increased intravesical pressure is propagated to the kidneys. It is a fact, of course, that a suprapubic opening of the bladder or an indwelling catheter will relieve this condition, and be followed by improvement in the renal function which is often strikingly marked. Such procedures are variously referred to as "relieving the back pressure on the kidney," or as "renal decompression."

The fact that such a result follows procedures which put the bladder out of action is undoubted; the conditions which exist previous to the institution of such suprapubic opening are far

from clear, however. How can there be any "back pressure," in a physical sense, on a kidney whose ureter is normal anatomically, and the ureterovesical valve of which is apparently competent? For I am sure that you will agree both from your own experience, as well as from the evidence which I have just discussed, that a degree of prostatic obstruction sometimes amounting to complete retention of urine, often occurs in which there is serious and easily demonstrable renal damage, but in which the ureters and their openings into the bladder are normal.

I can see no better way of explaining these conditions which we know to exist, than by assuming the existence in man of the reflux of urine from the bladder upward into the ureters, which we have noted as happening experimentally in animals. As we have already seen, the conditions surrounding the occurrence of this reflux are as yet quite imperfectly understood. Whether it occurs habitually in man, either under normal or pathological conditions, is not at all clear; and I am not in a position at present to do more than suggest to you the changes in our views on the mechanism of prostatic obstruction, which the assumption of such an upward reflux from the bladder would bring about. We are continuing the study of this subject both in the clinic and in the laboratory, and hope at a later date to bring before you more details concerning this most interesting phenomenon.

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DISCUSSION

Dr. G. G. SMITH: The question of regurgitation when the catheter is in place is entirely separate from the question of regurgitation of fluid at other times. When we have the catheter in the ureter, the latter is held open and it is possible for the fluid to get by the catheter. I think the work of Sweet & Stewart proves that increase of vesical tension tends to close the ureteral valve.

I would like to ask Dr. Quinby how he explains the action of the valve in regard to that.

Dr. SCHMIDT: For many years past observations have made me believe that in the vast majority of instances of paralyzed bladders, particularly those cases where the condition has been of long standing and wherever there is infection of the bladder, there is practically always a pyelonephritis present. Where I have been particularly interested in bladders of this kind, I wish to state that the ureteral orifices in practically all instances have been, as far as we can observe, normal in appearance, that the ejaculation of urine is with considerable force and regularity—yet in many instances where cystography has been carried out, the solution would enter the ureters and show these dilated ureters, often times showing enlarged pelves of the kidneys. Some of these cases, where there is a simple paralysis, are also accompanied by obstructive conditions. In practically all instances of paralytic bladders this phenomenon of regurgitation showed up and is usually double sided.

Dr. QUINBY (closing): I wish to express my great appreciation of the illuminating discussion which my paper has brought out.

Answering Dr. Chute's question I may say that a general anesthesia inhibits the secretion of urine by the kidney, and

therefore in that way lessens ureteral peristalsis. Dr. Kretschmer's work on this interesting reflux I am familiar with and have already referred to in my paper.

Answering Dr. Young's question, I may say that Leavin and Goldschmidt first showed this reflux phenomenon in rabbits and in dogs. Its occurrence, as far as we understand it at present, is not dependent on the pressure within the bladder. It is certain that it does not occur in a markedly distended bladder because in this condition of the bladder the uretero-vesical valve is tightly closed. On the other hand, if the bladder be filled with only a moderate quantity of a solution of certain characteristics of irritability or heat, the phenomenon appears. I should have mentioned spasm of the trigone as a logical cause for increased pressure in the ureter, as pointed out by Dr. Young.

DISSOLUTION OF CALCULI IN THE RENAL PELVIS AND URETER

ROBERT C. BRYAN AND R. D. CALDWELL

Prompted by an article "The Solubility of Phosphatic Kidney Stones" by Dr. J. F. Geisinger, appearing in the Journal of the American Pharmaceutical Association, April, 1918, the writer's attention was directed further to the feasibility of attempting the dissolution of renal and ureteral stones by the application of acids or other media designed to dissolve the stones.

GENERAL CONSIDERATION OF STONES

The recapitulation of the chemistry of stones shows the following:

Uric acid and urates form nuclei of about 81 per cent of urinary concretions, they are usually colored and smooth.

Uric acid crystals are soluble in 1 : 1500 parts of water at 20°C. They are also soluble by being oxidized in hot concentrated nitric acid. They are likewise soluble in alkalis, as sodium hydroxide stronger than 5 per cent, which solution is much too strong for tissue. These stones are not soluble in alcohol and ether, however.

The normal heat of the body and urinary pigments aid in keeping uric acid in solution.

Ordinary acid throws uric acid out of solution. These stones are soluble in potassium carbonate very slowly and should be boiled. Also soluble in lithium carbonate.

Urates are salts of uric acid. Urate calculi are rarely found in adults but may be found in infants. They are generally soft and highly pigmented.

Lithium carbonate acts on uric acid producing lithium urate, which is more soluble than other urates. Tried on pure powder of uric acid with no result at body temperature.

These calculi are soluble in concentrated hot acid solution. Both the above are found usually in acid urine, but may have phosphatic deposits around them in alkaline urine.

Calcium oxalate forms the nucleus of about 6 per cent of all stones.

Calcium oxalate calculi are next in frequency to uric acid calculi. These are the hardest stones and are usually very rough.

These stones are oxidized by warm permanganate in an acid solution, preferably in sulphuric acid solution, which the tissues could not stand. If in HCl, free chlorine, carbon monoxide and carbon dioxide would be given off. They are likewise soluble in dilute HCl.

Phosphates of calcium magnesium and ammonium are found soluble in any weak acid solution, best in hydrochloric acid yielding phosphoric acid and calcium magnesium and ammonium chloride.

Phosphates of alkaline earths form a nucleus for about 9 per cent of all stones.

Calcium carbonate calculi are rarely found in man but frequently in herbivora. They are soluble in any dilute acid with gas carbon dioxide given off.

Nearly all stones are mixtures of urates, uric acid, phosphates, etc., plus some organic framework. Finstires found but 6 pure stones in a series of 114 examined, but he did not state of what substance they were.

All stones have a framework of organic matter as fibrin, mucus and white blood cells which is left after the hard substance is dissolved out. This framework or skeleton remains after the dissolution, having practically the same size and shape as the original stones, but is soft and can be readily mashed between the fingers.

From the table of composition of stones given above we find that only about 13 per cent of stones are of such a composition as to allow an attempt of their dissolution while in the pelvis of the kidney. These, carbonates and phosphates, chiefly, are rarely pure but contain usually a nucleus of urates or uric acid

and are always intimately mixed and coated over with mucin, fibrin, bacteria and white blood cells which prevent the solvent from coming in contact with the inorganic material of the stones.

An interesting feature about the dissolution of stones by the constant application of acid, as has been shown by Dr. Geisinger's monograph, is that the stones contain some organic matter, which, while saturated with the solution, remained as large as the original stone and of the same color but of such a consistency that they could hardly be handled without breaking, and could easily be moulded into any shape. On drying this residue would contract to about one-tenth of its original size and become dark brown to black in color.

After a series of experiments by Dr. Geisinger, 2 per cent aluminium acetate, 5 per cent ammonium chloride and 1 per cent hydrochloric acid were used in the dissolution of the stones; the effect of these acids upon the stones is shown in the following table:

STONE	WEIGHT	SOLUTION USED	NUMBER OF DROPS	NUMBER OF CUBIC CENTIMETERS USED	NUMBER OF CUBIC CENTIMETERS USED PER MILLIGRAM	WEIGHT OF RESIDUE
	grams					
A	0.1778	2 per cent aluminium acetate	25	500	2.81	0.1694
B	0.3352	5 per cent ammonium chloride	27	2000	5.98	0.3302
C	0.1316	1 per cent hydrochloric acid	19	2500	19	0.011
D	0.1694	1 per cent hydrochloric acid	20	720	4.25	0.0132
E	0.1818	1 per cent hydrochloric acid	15	80	0.44	0.0118

Having ascertained that HCl was the most desirable of all media for the dissolution of stones many interesting phenomena developed as our studies progressed, among others the strength of the solutions to be used and their effect upon the normal mucosa of the ureter and pelvis of the kidney.

Catheterization of the ureters in the male dog is an impossibility and on several occasions the writer has attempted to catheterize the ureters of the female dog with more or less success.

To further our studies then, dogs were anesthetized and the ureter segregated and submitted to the action of acids, which showed the following:

First dog. Female dog, weight 14 pounds, 636 kgm., 25 cc. H_2O by mouth per kilogram of body weight; 1 cc. phenolsulphonephthalein injected in buttock muscles. Thalein appeared in urine in ten minutes. Twenty-four per cent phthalein output in first hour, could not obtain specimen second hour. Three days later dog anesthetized with ether, 5 cc. 10 per cent HCl injected through ureter into pelvis of left kidney. The dog was dead in two minutes after injection. Dog's blood was faintly acid to litmus after death. Five minutes after injection of acid the kidney was removed and washed, splitting the kidney in half longitudinally. Microscopic examination of ureter and pelvis of kidney showed slight coagulative necrosis of mucous membrane lining the pelvis of the kidney. When the kidney was cut open longitudinally cortex and medulla showed brown streaks from action of HCl on blood. The pelvis was white and brittle.

Second dog. Dog anesthetized and 5 cc. of 5 per cent HCl injected into pelvis of kidney as in other case. There was no change in pulse or respiration. Fifteen minutes later the kidney was removed and washed. The organ was streaked with brown very much the same as in the case of 10 per cent acid but not as much. Microscopic examination of the pelvis showed no change in cells.

Third dog. Dog anesthetized and 1 per cent HCl (3 cc.) injected into pelvis of kidney as before, twenty minutes later the kidney was removed and washed. The macroscopic appearance was normal and no change could be noted on microscopic examination of the pelvis.

Remarks: In all these cases the kidney substance was diseased due to long standing nephritis in the dogs and not to the acid injection. No microscopic change in the kidney other than congestion because the dogs were killed before the tissue had time to react.

The following series would indicate that there is a distinct pathologic response to 5 per cent solutions of HCl.

Dog 1. Five per cent HCl injected into the right ureter through abdominal incision of small dog. Six days later the dog was killed with chloroform and severance of carotid artery, and the following noticed: Right kidney large and pale. Pelvis and ureter soft, yellow

and easily broken. The kidney was opened through midline incision and it was filled with pus and entire, or nearly all of medulla had sloughed away. The kidney had enormous blood supply. Microscopic section showed left kidney normal. Right kidney filled with pus, congested and all of mucous membrane, pelvis and part of medulla gone or chiefly a mass of pus cells. Section of ureter on right side showed wall and lining mucous membrane replaced by a mass of pus cells.

Dog 2. Five per cent HCl injected into right ureter in the same way. After twenty-four hours the dog was killed with chloroform and severing carotid artery. Mucous membrane of both the right ureter and pelvis showed complete destruction and surrounding tissue congested and heavily infiltrated with polymorphous nuclear leucocytes.

Dog 3 (*primo*). Small poorly nourished dog. In the usual way the dog was anesthetized and 1 per cent HCl injected into right kidney through ureter. The dog died at the end of two days. Right kidney slightly larger and presented a pale appearance. Microscopically the kidney was congested and the mucous membrane was destroyed from the pelvis of the kidney and infundibulum of the ureter.

Dog 4 (*primo*). One-half of 1 per cent HCl injected in usual way. Dog died in a few hours, sometime the following night. Was sick and poorly nourished which accounts for death. General appearance of the kidney normal. Microscopically the kidney pelvis showed slight vascularity and round cell infiltration under the mucosa, mild sloughing of mucous membrane in spots with cloudy swelling of marginal cells of mucosa. Ureter showed same changes.

Dog 5 (*primo*). One-half of 1 per cent HCl injected and dog killed in seven days. Kidney normal size, pale, appearance congested and round cell infiltration beneath the mucosa with hyperplasia of mucous membrane showing there had been some destruction followed by repair. Ureter showed same changes. At the end of six days the dog showed 100 per cent phthalein output.

Dog 6 (*primo*). One-fourth of 1 per cent HCl injected as usual. Kidney normal in size and appearance. Mucous membrane normal, slight increased vascularity and round cell infiltration in tissue beneath mucosa. Ureter normal. This dog was killed at the end of six days.

MacNider, Chapel Hill, North Carolina, states that most dogs have Bright's disease, probably due to mange and skin infections producing a glomerular nephritis. Urine may be normal, free from albumin, of a normal specific gravity, but there

is a decrease phthalein output averaging around 45 per cent. This glomerular nephritis is evident by microscopical section in all cases. It would seem, therefore, that the moth ball test of the dog for an accurate estimation of the kidney output is based upon false premises, although in one of our cases, dog 5, primo, showed 100 per cent phthalein output.

At first our intention was to do a nephrotomy placing a human stone in the pelvis of the dog's kidney and in other instances smaller ones in the ureter. This latter proposition, however, did not appeal to us as it would have produced blocking of the ureter and establishment of a nephrostomy wound, with the added possibilities of infection. Placing a stone in the pelvis of the kidney would give rise to an unnatural state which would not obtain in the normal and this plan was abandoned.

Dr. Geisinger recently reports a case in which a stone was brought from apparently the uretero-pelvic junction to the brim of the pelvis by irrigations of the ureter and pelvis of the kidney with hydrochloric acid, dissolving sufficient crystals to allow the framework above mentioned to adapt itself to the shape of the ureter and by the vermicular action of the same to be projected downwards, and I believe at present he is engaged in a series of investigations which will be reported later.

The case which we herewith report, in whom the stone was removed by operation following repeated attempts at dissolution with 0.8 per cent U. S. P. hydrochloric acid was placed in the patient's urine, made 0.5 per cent acid with hydrochloric acid. At the end of 36 hours the stone could be crushed between the fingers to little granules like sand of the inorganic material surrounded by soft gelatinous material, which proved to be fibrin and blood.

Another portion of the calculus after being in patient's urine made 5 per cent acid with HCl for thirty-six hours remained the same size, but the inorganic material was a small speck in the center surrounded by gelatinous material.

CONCLUSIONS

1. The means for determining the character of stones can be estimated only by the density of the shadow by X-ray, and by urinalysis, at which time we hope to catch crystals from the stone which may be most misleading.

2. The only stones amenable to dissolution are the phosphatic, which constitute only 9 per cent of all stones, and the calcium carbonate (very rare), which constitute 4 per cent of all stones.

3. Stone formation is always attended with the presence of pus. This condition is aggravated by topical applications.

4. Many stones may be assisted in their expulsion by ureteral dilatation and lubrication.

5. Operation, in the upper tract, pyelotomy, in the lower tract, by intramuscular gridiron incision, is attended with such happy results that experimentation with solvents would seem impracticable.

6. The mucosa of the dog lining the pelvis and the ureter can stand 0.5 per cent hydrochloric acid U. S. P., stronger than this shows a round cell infiltration and destruction which in course of time is not followed by repair.

J. M., 2826 Mile Road, City. Age thirty-seven, F., single, American. Occupation housework.

Admitted to the Virginia Hospital, September 6, 1920 probable diagnosis renal lithiasis. On admission temperature 99.4°, pulse 88, respiration 22.

History

C. C. Pain in left side of back, lower part. Began about a year ago, and has been getting worse up to present time. Pain not constantly present but is brought on when patient is walking or resting on her back, when lying on side in bed pain does not give nearly as much trouble. Voiding caused pain to become worse for a short while. Pain comes on in attacks, some severe enough to cause patient to go to bed.

Head. Patient suffers with headache constantly, worse at night. Dizzy at times, feels as if she is going to fall.

C. R. Edema of ankles upon standing, shortness of breath upon slight exertion. No cough, expectoration, hemoptysis or night sweats.

G. I. Appetite not good. No indigestion, abdominal pain or history of jaundice. Habitually constipated, nauseated after eating, especially meats, no vomiting. Hemorrhoidectomy ten years ago.

G. U. Nocturia, one or two voidings, but patient has had very frequent night voidings, about two weeks ago pain upon micturation followed by burning, no retention or difficulty in voiding, but a tendency to incontinence at times.

M. H. Began at fifteen, lasts four to five days, regular up until ten years ago at which time patient underwent abdominal operation on pelvic organs, has not menstruated since, no vaginal discharge at present time. No history of gonorrhoea or syphilis, one child born and miscarriage two years after marriage. Married at 17.

Habits. One cup of coffee per day. No insomnia, loss of weight in past year.

F. H. Father living, mother dead, 2 brothers living, 2 sisters living. History of cancer, syphilis, T. B. and insanity negative.

P. I. Patient has had usual childhood diseases. Typhoid last year. Appendicitis and operation fifteen years ago, operation on pelvic organs ten years ago. Operation for gall stones last year and abscess of abdomen one month after gall bladder operation in incision of same operation.

Physical examination. Negative except for scar of previous operation and a marked tenderness over left kidney region in back. Pressure there causes a sick sensation.

Urinalysis, September, 7, 1920. Yellow, cloudy, 1020, acid, very slight trace of albumin, sugar negative, acetone negative, diacetic acid negative, indican negative, very few pus cells and mucus.

September 7, 1920, X-ray for calculus. Patient has small stone approximately $\frac{1}{2}$ by $\frac{1}{2}$ inches in the pelvis of the left kidney. The kidney is normal in shape, size and position.

September 15, 1920, cystoscopic examination. Bladder mucosa, trigone and ureteral ora normal. Both ureters catheterized, no obstruction. Specimens collected. Dye test appearance from both kidneys 5 minutes.

September 15, 1920. Right kidney 20 cc. 10 per cent, microscopic abundant blood, few pus cells.

September 15, 1920. Left kidney 20 cc. 20 per cent, microscopic abundant blood, few pus cells; 40 cc., 30 per cent total. Bladder 5 per cent.

October 7, 1920, X-ray of left kidney. The small calculus referred to

in previous report is still present in pelvis of left kidney. In addition to this there is a very faint shadow about the same size, or probably a little larger which is probably a second calculus. The latter is situated ½ inch above the former.

October 8, 1920, urinalysis. Few amorphous urates, very few pus cells, some mucus.

October 11, 1920, cystoscopic examination. Urethra, bladder mucosa and left ureteral os are normal. The left ureter is readily catheterized, catheter reaching the pelvis with no difficulty; 4 cc. of urine is aspirated from the left pelvis and 5 cc. of a 0.6 per cent solution of hydrochloric acid is then injected into the pelvis of the left kidney with the patient inverted. There is no evidence of pain or discomfort. This is held for three or four minutes, the pelvis again aspirated, 3 cc. being obtained and 5 cc. of 6.1 per cent solution of hydrochloric acid again injected into the kidney. Some bubbles come away which are caught through water and this is subjected to examination and proved to be only air. The patient complained of no pain at any time during the operation. There are no evidences of trauma.

October 12, 1920, urinalysis. Yellow, cloudy, 1020, acid, trace albumin, sugar negative, acetone negative, diacetic acid negative, indican negative, frequent blood, abundant bacteria.

October 13, 1920, blood examination. White cells 9,201, polys 75, small lymphocytes 25.

October 16, 1920, X-ray of left kidney. Calculi are still present. As there was some movement of the kidney during exposure it is impossible to state the size of the calculi as compared to previous plates.

October 18, 1920. Left ureter catheterized, 5.5 cc. of normal appearing urine aspirated. Kidney is injected with 6 cc. of 0.6 per cent solution of hydrochloric acid, table inverted and fluid kept in contact with stone about ten minutes. No ebullition of gas is noted.

October 20, 1920, urinalysis. Yellow, cloudy, 1012, acid, albumin light trace, sugar negative, acetone light trace, diacetic acid negative, indican negative, good deal of sediment, good many triple phosphates, few pus cells.

October 22, 1920, urinalysis. Light amber, clear, acid, 1010, very faint trace of albumin, sugar negative, debris, bacteria, etc., found in twenty-four hour specimen, moderate number of pus cells, occasional red blood cell, no epithelium or crystals (twenty-four hour specimens second day after injection of 0.6 per cent HCl into pelvis of kidney).

October 23, 1920. Patient went home, no X-ray being taken because of the fear of X-ray burn, she having had several in the last two weeks.

November 14, 1920. Has pain in left side, particularly at night, urine burns, no medicine, drinks large quantities of water, appetite fair, bowels good, pain runs to neck of bladder.

November 20, 1920. A concretion approximately 3 mm. by 2 mm. is seen in the region where the pelvis of the kidney was seen to be on previous X-ray examination.

January 15, 1921. Returns to hospital. Has had considerable pain and distress in costo-vertebral angle and along course of ureter.

January 20, 1921. X-ray shows two small stones in the same location as the former shadows.

January 21, 1921. The left ureter is readily catheterized, the catheter mounting to the pelvis of the kidney with apparently no embarrassment, pain or trauma. Aspiration of the pelvis is attempted but nothing returns. The patient is gently inverted and 9 cc. of an 0.8 per cent solution of U. S. P. HCl is injected slowly into the pelvis of the left kidney until there is evident tension. This solution is left in contact with the lining of the pelvis for three minutes, then allowed to return and the pelvis is irrigated with sterile water. There is marked spasm of the ureter on attempted withdrawal of the catheter so much so that it isstarted with considerable difficulty. The specimen herewith is the returning HCl through the catheter from the kidney.

January 22, 1921, urinalysis. Yellow, cloudy, 1012, acid, albumin heavy, sugar negative, acetone negative, diacetic acid negative, abundant blood cells.

January 26, 1921. Wassermann negative.

February 2, 1921, blood count. 8,400, 76 polys, 22 small, 2 eosin.

February 2, 1921, urinalysis. Yellow, clear, 1012, acid, no albumin, very few pus cells and blood cells, little sediment.

February 14, 1921, operation. General anesthetic ether, left kidney incision. The kidney is readily reached, delivered, stripped of fat, is apparently normal in shape, color and outline. A long straight needle is thrust through the convex border just below its center and a distinct click is noted. The kidney is held firmly in the left hand and an incision made along the convex border to the pelvis. The finger in the pelvis feels no stone, but continuing the incision a very small stone is found embedded in the substance of the kidney in one of the lower papilla, surrounded by fibrous tissue. The fibrous tissue is scraped away and the stone readily removed. The kidney is brought together with mattress sutures, four in number, superimposed continuous catgut no. 2 through capsule. A small wick of rubber is placed in the kidney bed

and brought out at the lower angle of the wound. Tissues approximated with catgut no. 2, silkworm gut through skin.

February 22, 1921. Stitches removed.

February 28, 1921. Patient up in chair and about.

The writer wishes to express his thanks to Dr. Jos. F. Geisinger, whose advice, suggestions and collaboration have at all times been most appreciated and who has offered his monographs and tables which have been freely used in this article.

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GENITAL TUBERCULOSIS IN MALE CHILDREN

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Although tuberculosis in one form or another is common in children, this disease seems to attack the genital and urinary organs with comparative rarity, a point on which most investigators are in agreement. There is reason to believe, however, that tuberculosis of the genital tract is not so uncommon as has been supposed, the difficulty lying in the fact that it may be mild, that a spontaneous cure may be effected, and that because of these facts the condition may be either overlooked or ascribed to an infection by organisms other than the tubercle bacillus. Be that as it may large numbers of cases have not been reported.

Poissonnier (1) in 1907, in a very complete review of the subject of infantile genital tuberculosis, collected 91 cases from various sources, the greatest number, 44, having been observed by Broca (1) among 46,000 juvenile hospital inmates. Since this time various writers have reported from 1 to 3 or 4 cases each, so that it would not appear that advances in diagnostic acumen were reaping a much richer harvest.

It is not, therefore, surprising to find that the Massachusetts General Hospital has shared in this comparative paucity of material. A search of the records from 1872 to date reveals a total of 11 such cases, among 401 admissions (including reëntries) for this condition, giving a percentage of 2.74.

Varous statements are made to the effect that the disease affects particularly very young children, decreasing in frequency as puberty approaches. Poissonnier, among 89 cases found 42 occurring before the second year, 47 between the second and

fifteenth year. Among our 11 cases the youngest was 9 months, the others being respectively 18 months 2 years, 2½ years, 5 years, 6 years, 6½ years, 7 years, 8 years, 12 years and 14 years of age. That the nursing infant is not spared is shown by two such patients reported by Swoboda (2), and we are even informed that a case of this disease in a fetus at term has been observed by Drechsfeld (quoted by Poissonnier (1)).

In our series of 11 cases both epididymes were found to be involved at the time of entrance in one case (an infant of nine months); in another case (a boy of eight years) the second side became involved twenty-seven months after removal of the epididymis first affected, while in a third case the involvement of the second side took place within three months after excision of its tuberculous mate (orchidectomy). These facts seem to be in accord with the views of other writers especially Kirmisson (3) and Poissonnier (1), the latter having collected but 7 bilateral infections out of 42 cases. Bilaterality of the disease in children is therefore far less common than in adults. My own statistics, published some years ago (4), showed that at the time of entrance to the hospital both sides were involved in 29.3 per cent of 150 adult cases, while König (4) found bilateral lesions in 75 per cent, and von Bruns (4) found both sides involved in 38 per cent. At the Tübingen clinic 29 per cent of 111 cases were found to be bilateral (4).

The remaining 8 cases in our series showed about an equal distribution of the disease between the left and right sides.

Kirmisson (3) states that in adults the testicle itself is often intact, whereas in children this organ is frequently diseased. On the other hand Vignard and Thevenot (2) assert that the testicle and epididymis are attacked simultaneously, a view which is shared by Poissonnier who states that the burden of infection is shared equally by these organs.

Our own experience shows that in only two instances was the testis itself definitely tuberculous, but it should be stated that the pathological reports, more particularly those of an earlier day, are very vague as to their differentiation between testicle and epididymis. I believe that there is much less frequently

an involvement of the infantile than of the adult testicle and that in most cases it is no more necessary to remove the testicle of a child than that of an adult. Indeed it may be said that the removal of this organ from patients under the age of puberty should be done only as a last resort, with much less impunity than in the adult, owing to the demand upon its invaluable internal secretion as puberty approaches.

While the formation of a scrotal abscess with spontaneous rupture and the establishment of a fistula may occur in children as in adults, it certainly is a far less common phenomenon. I have already showed that such an event takes place in over 76 per cent of adult cases whereas in the children now under discussion scrotal fistula was found but three times.

While it is unfortunate that our records definitely state that the vas deferens was involved in but two instances there is no reason to believe that the seminal duct of children is less frequently invaded by tuberculosis than that of the adult. In the latter, such an involvement is found in the great majority of cases and according to Poissonnier the vas was definitely tuberculous in 18 out of 28 children in whom this point was noted.

It is unfortunate also that in so few cases is not only the condition of the vas deferens, but also that of the prostate and seminal vesicles unrecorded. Since so much hinges on the knowledge of the condition of the latter organs not only from the scientific, but also from the prognostic view point, it is disappointing to find that no mention whatever is made of these organs by many observers. While it is true that in children rectal examination is not easy and may be productive of pain, the facts can readily be ascertained if and when the child is anesthetized for operation.

The records of our cases compare favorably with others in this respect, definite statements as to the condition of the prostate or seminal vesicles or both having been made in 6 cases, twice at autopsy and in the other 4 either at or after operation. Of the latter, in a boy of eight years, the seminal vesicles were recorded as "palpable" and "very tender" before operation, whereas over two years later, tuberculosis of the second epididymis and

of one kidney having meantime intervened, the record states that the "prostate is normal and the vesicles are not felt." In a boy of fourteen with unilateral epididymitis of short duration it is recorded that "nothing is felt in the prostate," and in a child of five with a tuberculous epididymitis of over two years duration on the one side, and of three to four months standing on the other, we are told that the rectal examination was "negative." Finally a boy of seven having a unilateral orchidectomy in 1905 was examined at the hospital in 1911 and was found to have a normal prostate and seminal vesicles and the remaining testis and epididymis free from disease.

Although these cases will be dwelt upon later at greater length I may say that in two cases seen at autopsy, one with bilateral disease and unoperated, showed an extensive involvement of the seminal vesicles and a slight and early invasion of the prostate, whereas the second case having had an operation on one tuberculous testicle died, twenty-six days later, and was found to have a normal prostate and seminal vesicles. Thus 5 out of 6 cases are known to have had no demonstratable lesion of the prostate or seminal vesicles.

Kantorowicz (4) in 57 cases of epididymal tuberculosis in children found the prostate involved but twice. Broca (1) who examined all of his 44 cases, is reported never to have found a lesion of the prostate or vesicle. In support of these views Kirmisson (3) states that it is much more rare than in the adult to find lesions of the prostate and seminal vesicles in children. On the other hand Vignard and Thevenot (2) state that in these young children "the vesicles and prostate are often the seat of indurated nodules or of suppuration." There seems, therefore, to be a difference of opinion but I am inclined to believe that the question of prostatic and vesicular tuberculosis could be definitely settled were careful routine examinations made of these organs. It is worthy of note, however, that in a quite careful review of the literature of this subject no mention whatever is made of any instances of tuberculosis of the prostate or seminal vesicles being noted *before* the onset of epididymitis.

From what has been stated we may conclude that while tuber-

culosis of the prostate and vesicles may and does at times occur in children it is certainly far different a situation than that which exists in the adult. In previous investigations of this question I found that in the adult these organs were definitely involved in 76 out of 101 cases and I remarked at that time that "the combined experience of all observers shows that prostatic and vesicular tuberculosis is most frequent during the time of the greatest activity of these organs, i.e., from about the twentieth to the fortieth years." (4)

The comparative freedom from disease enjoyed by the infantile prostate may well account for the fact that I have nowhere seen it stated in the literature, nor has it been our experience that bladder irritability or abnormal urinary constituents played a great part in the symptomatology of this disease in children. It also seems to be true that while in the adult renal tuberculosis sooner or later intervenes in a considerable number constituting true "genito-urinary tuberculosis," this combination attacks the child with comparative rarity. In our 11 cases there was but one, a boy of eight years, with renal tuberculosis, a complication which was discovered shortly after his first appearance at the hospital. In 2 other cases the urine contained a few leucocytes and the slightest possible trace of albumen. Other than this there is no evidence in these cases of any damage to the urinary tract either before of after operation.

It is generally recognized that while the primary focus of tuberculosis in the urinary tract is in the kidney and while there are those who believe that in the genital tract this focus lies in the epididymis, it is equally certain that both foci are really secondary to a third. The statistics of all writers agree that this focus is generally in the lung or bronchial lymph-glands, and while it cannot always be demonstrated by the ordinary bedside methods of chest examination, the X-ray will reveal it in almost every instance.

In the 11 children here presented there was evidence of lung involvement in 5, of tuberculosis peritonitis in 2, of chronic otitis media (probably tuberculous) in 2, of bone tuberculosis in 2, of cervical adentitis in 1. In 3 cases no definite focus was

established. It is obvious, therefore, that while disease of the lungs heads the list, it is equally clear that in a few there was evidence of active tuberculosis in more than one focus outside of the genital tract.

In view of these findings it is not surprising to observe that 8 of the 11 cases were in bad condition when admitted to the hospital, loss of weight, anaemia, rhachitis and malnutrition being predominant features. Such a large percentage of poor risks is in distinct contrast to the picture one often sees presented by the adult suffering from a similar involvement of the genital tract. As often as not he is well nourished, and superficially sound in appearance, the foci of disease being discovered sometimes only after the most painstaking search.

The surgical treatment of these cases consisted of orchidectomy in 7, and epididymectomy in 2 (of which 1 was bilateral). Of the remaining 2 one was unoperated and died of meningitis shortly after coming to the hospital, and the other was so occupied with the relief of his tuberculous peritonitis, and later of his empyema, that the treatment of his epididymis was left for another occasion.

A pathological examination of the tissue removed was made in 8 cases, all of which showed the characteristic lesions of tuberculosis. It is of interest to note that in 6 of these cases the presence of caseation indicated that the process was of long duration, much longer than would be supposed from the history obtained.

The outcome, more or less complete, is known in 10 of these cases.

One child of two having left orchidectomy was brought back the following year with a relapse on the opposite side. No further facts are known.

A boy of six and a half years was seen a year after the removal of the right testicle and epididymis. His general and local condition were satisfactory as was that of the opposite testicle. The urine was negative.

Another boy of twelve returned a year after unilateral orchidectomy in excellent general condition.

A fourth case, five years of age, was seen three and a half years after bilateral epididymectomy. The note reads "General condition excellent. Good appetite and has gained weight. Urine clean, negative. Has diurnal frequency. Scars not adherent to testes, no induration." This case is interesting as at the time of operation the child had a bad interstitial keratitis and many râles in the lungs.

Another boy of seven was in very good general condition at the time of his unilateral orchidectomy. He returned six years later when the following observation was made. "General condition good. Has gained in weight. No urinary symptoms. Right testis and epididymis normal. Prostate and vesicles normal. No fistula. Urine negative."

A sickly boy of fourteen entered with tuberculosis peritonitis, an old Pott's disease of the spine, and a unilateral epididymitis. After expectant treatment and being improved he was discharged. Nearly a year later he was readmitted for a cold abscess of the abdominal wall which was incised and drained. He was discharged in due time only to return three months later with empyema which was relieved by tapping. The condition of the epididymis had meantime grown somewhat worse but there was "nothing felt in the prostate." A few days later he was operated upon for empyema, an operation from which he recovered fairly well. During the next three years he was a frequent visitor to the out-patient department, remaining in very fair condition. Since no note is made as to the condition of the genital tract it may be inferred that the disease was at least quiescent.

A boy of eight came in for the relief of a scrotal abscess. Left epididymectomy was performed. A positive guinea-pig test of the bladder urine showed the presence of renal tuberculosis. Nearly three years later, the boy meantime having failed, he was readmitted and a left nephrectomy was performed. The opposite epididymis had meantime become involved.

During the next year or two he returned to the out-patient clinic and during this time he developed a tuberculous stricture of the bulbous urethra, which required frequent dilatation. It

may be said also that he was meanwhile being given tuberculin and kept under good hygienic surroundings, yet in spite of these measures his decline was slow but steady. I have reason to believe that he is now dead.

Three of these children are known to have died, a mortality of over 27 per cent, but a figure which does not by any means give the facts, as none have been followed a sufficient length of time. As I have already pointed out "my experience warrants the conclusion that until at least ten years have elapsed after operation, no patient can be said to be cured of genital tuberculosis." Further and more recent observations have only served to confirm the truth of this statement.

A child of one and a half years had unilateral orchidectomy. In addition to the genital tuberculosis, he had a chronic otitis media, cervical adenitis, and a tuberculous process of the ankle —altogether he was in poor shape. The wound had not healed at the time of his discharge, six weeks after operation. There is a note in the record to the effect that the patient died about four years later. The cause of death is not stated.

Autopsy was obtained on the following cases.

One was a boy of six years. There was a family history of tuberculosis and the patient is said to have had "meningitis" four years before entrance. For some time he had been in poor health, with a cough, fever, abdominal pain and vomiting, loss of weight and for two months had had a swollen scrotum. There were no urinary symptoms.

Physical examination showed a pale, sickly child. There was definite tuberculosis of the left lung, and evidence of tuberculous peritonitis The left scrotum was occupied by a large, hard, nodular mass. Orchidectomy was performed under ether. The pathologist stated that the "testis was studded with tubercles and the cord was found in the same condition." After a stormy convalescence the patient developed tuberculous meningitis and died on the twenty-sixth day after operation.

Autopsy showed tuberculosis of the bronchial lymph glands, miliary tuberculosis of the lungs, liver, spleen and kidneys, tuberculous peritonitis, tuberculous meningitis, a solitary tuber-

cle of the cerebellum, left otitis media, chronic pleuritis. The bladder, prostate, seminal vesicles, and right testicle were "*not remarkable.*"

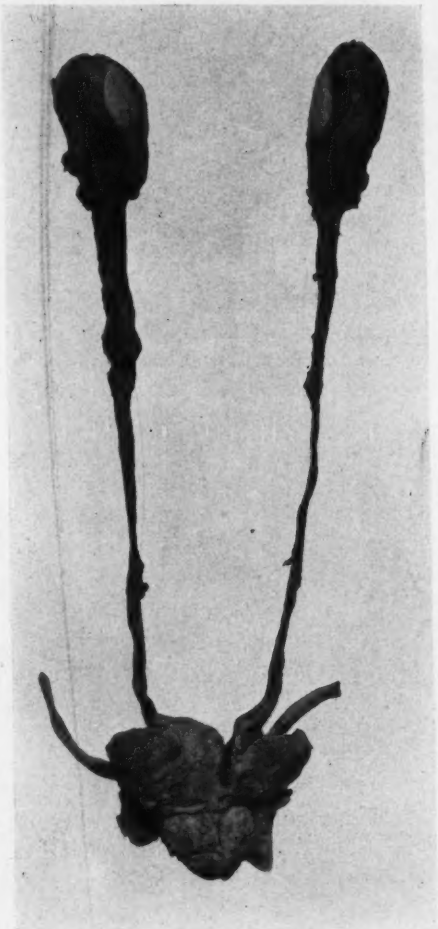

FIG. 1. ENTIRE GENITAL TRACT OF CHILD NINE MONTHS OF AGE

The middle portions of the vasa are of normal size. The seminal vesicles are greatly distended.

FIG. 2. ENLARGED VIEW OF PROSTATE, VESICLES AND AMPULLAE

Prostate is of normal size; vesicles and ampullae, especially the left, are enormously distended.

FIG. 3. TESTES AND EPIDIDYMES

Testes are entirely normal; epididymes are completely caseous and much enlarged.

The last case was that of a baby of nine months seen last December in the Children's Medical Service at the Massachusetts General Hospital in consultation with Dr. F. B. Talbot. The family history was negative. He was well up to the seventh month when he developed a middle ear abscess followed by mastoiditis requiring radical operation. This process never entirely healed. Two months before coming to the hospital he developed a swelling of the left scrotum. At the time of entrance the child looked emaciated and sick. There was a chronic discharge from the ear and subsequent X-ray examinations of the chest showed a glandular and peribronchial process, probably tuberculous. The urine always contained albumin and a few leucocytes. Search for the tubercle bacillus was negative. There was moderate leucocytosis. Von Pirquet test was strongly positive. Both epididymes were swollen, especially the left, and firm and nodular. Scrotal skin adherent. Moderate tenderness.

Some days after entrance the child developed bronchitis and tuberculous meningitis to which it succumbed 46 days after entrance.

Autopsy showed tuberculous ulcers of the intestines, tuberculosis of the mesenteric, retroperitoneal, and bronchial lymph glands, and miliary tuberculosis of the lungs, liver, spleen and kidneys. There was also meningeal tuberculosis.

The entire genital tract was dissected out for me by our pathologist, Dr. Oscar Richardson, to whom my thanks are due, as may be seen in the accompanying illustrations (figs. 1, 2, 3).

The epididymes are much enlarged and caseous throughout. The testicles show no macroscopic changes. The vasa deferentia are thickened to the size of a goose quill at the outer thirds of their length, whereas in the middle thirds there is no gross abnormality. The ampullae are enormously distended. Both seminal vesicles, especially the left, are several times their normal size and on section are extensively caseous, there being but little normal tissue left. The prostate is of essentially normal size and appearance. On section it shows caseous areas within and immediately around the ejaculatory ducts throughout their entire course through the prostate. In one lateral lobe there is

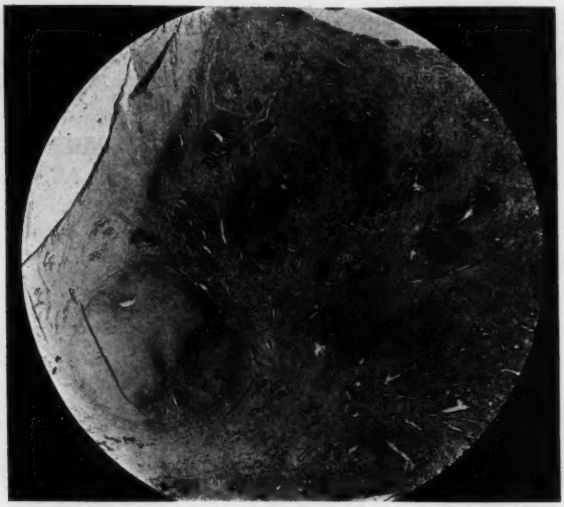

FIG. 4. LEFT LOBE OF PROSTATE, SHOWING TUBERCULOSIS OF THE EJACULATORY DUCT

The opaque area in upper portion shows foci of necrosis

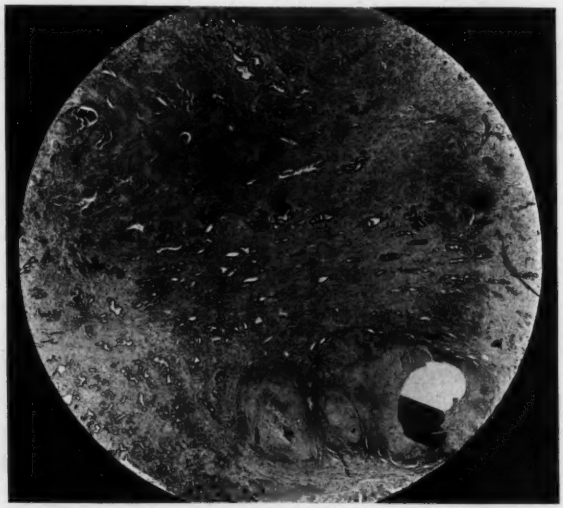

FIG. 5. RIGHT LOBE OF PROSTATE SHOWING A FEW RECENT TUBERCLES

an ill-defined, partly caseous area occupying about one quarter of the lobe.

Microscopic study of these organs was kindly made for me by Dr. James Homer Wright to whom I express my sincere thanks.

Prostate. The opaque areas in the region of the ducts are typical ejaculatory tuberculosis, with much necrosis. The opaque area occupying about one quarter of the left lateral lobe shows small foci of necrosis in a cell-rich inflammatory tissue, in which are many epithelioid cells and some fibrous tissue. In the other lobe there are some small focal accumulations of epithelioid cells undergoing necrosis and constituting apparently recent tubercles. The microscopic appearances suggest a more recent process than in the ejaculatory ducts and in the epididymes (figs. 4 and 5).

Epididymes. The enlarged caseous epididymes show appearances of tuberculosis of more long standing character. But little of the original tissue remains. As indicated by the gross appearances the tissue is largely necrotic, but actively growing tubercles are present at the margin of the necrotic mass in the fibrous inflammatory tissue. The testicles are normal.

Spermatic cord. Sections from the median portion show appearances of tuberculosis.

Certain writers such as Vigard and Thevenot have attempted to divide genital tuberculosis into two groups, namely those in which the affection is essentially primary in the genital tract, and those in which this involvement is a secondary feature to visceral tuberculosis. I do not believe that this grouping is desirable or accurate as I believe that those placed in the second group are merely the more advanced stages of the first. The ultimate results of these cases would appear to confirm this view.

There seems also to be a considerable division of opinion as to treatment of this condition. While practically all are agreed that general hygienic measures, to which the use of tuberculin is added by some, are essential to the prospects of cure, the handling of the local disease is a bone of contention. Jullien (1) in 1889, and Rocher (1) in 1904, expressed strong objections to surgical intervention or only such as was absolutely necessary. On the other hand Felizet (1) in 1899, and Phocas (1) in 1898, advocated more radical measures involving castration.

More recent writers such as Poissonnier (1) think it unwise to use anything more radical than the curette when the case is complicated by tuberculosis of other parts. Vignard and Thèvenot (2) think that those cases occurring in the first group in which the genital infection is a primary isolated manifestation, should be submitted only to the most conservative measures, whereas those in the second, with active lesions elsewhere, should have castration. They finally ask, however, if the difference between the primary and secondary forms is as great as one thinks.

As to the ultimate results of these cases in children Jullien says that he has lost none of 20 cases. Hutinel and Deschamps, (1) on the contrary, have lost 6 out of 9 cases. Vignard and Thèvenot (2) lost 2 out of their 3 patients, one dying six months, the other two months after the onset of the local infection. Most of the statistics on this point which I seen are of little value, however, as there is no evidence that the patients have been followed for a sufficient length of time, an objection which applies to the cases which I have here recorded. I have already expressed the opinion that until at least 10 years have elapsed after operation, no patient can said to be cured of genital tuberculosis.

Since the question of the primary focus and of the means by which the disease spreads from this focus to other organs, is still open to question. I think that the views of two authoritative students of the problem, although at variance, are none the less interesting.

After many years of study of this question and basing his opinion on the results of 200 autopsies of those dying with genital or genito-urinary tuberculosis Simmonds (5) comes to the following conclusions.

1. The primary focus in the genital tract proceeds from the prostate in one-half the cases, while in one-quarter of the cases it arises in the seminal vesicle or in the epididymis. This statement is based on 40 autopsies in which he found the prostate alone involved in 20, the seminal vesicles alone in 10, and the epididymis alone in 10.

2. From these centers the process can proceed in the direction of the testicle or away from it.

3. The process of healing seldom occurs in the prostate and seminal vesicles, while in the hilum of the testicle cicatrization is frequent.

4. The prognosis of male genital tuberculosis, particularly that of the seminal vesicle, is bad. The chief danger lies in the onset of tuberculous meningitis or of miliary tuberculosis. One-third of the cases of genital tuberculosis in men die of this complication.

5. In the autopsies of 20 men having previous castration for genital tuberculosis there was always found an involvement of the intraabdominal portion of the genital system. Healing was not observed in these cases.

6. On the grounds of anatomical experience, therefore, simple castration in genital tuberculosis cannot be considered satisfactory.

Simmonds himself acknowledges that there is a marked discrepancy between the clinical results and anatomical findings but is unable to explain it. On the strength of his own pathological experience he advocates vesiculectomy, but feels that prostatectomy for tuberculosis is a dangerous procedure.

Kraemer (6), an equally authoritative and ardent student of the question, disagrees with Simmonds, basing his views on clinical as well as upon anatomical findings. He believes that the spread of tuberculosis with the natural secretory current within the male genital system holds true, and finds not only, no evidence against this view in Simmonds' work, but even every evidence to support it. Regardless of what Simmonds found at autopsy Kraemer believes that the undeniable fact that 80 per cent of permanent cures of genital tuberculosis in the male are reported by surgeons in general controverts any statement. If, he argues, the prostate is the primary focus, how can the removal of a secondary focus in the testicle produce this result. The difficulty lies in the fact that the cases seen by Simmonds had the misfortune to die and were among those which the clinician failed to cure. Furthermore, as Simmonds himself acknowledges, the deaths are largely from miliary tuberculosis and meningitis, and these lesions might just as well be produced by the

focus which gave rise to the genital infection, as by the genital infection itself.

Simmonds, in a subsequent article refutes all of Kraemer's statements. He claims that one finds recent tuberculous changes in the epididymis along with far advanced changes in the prostate and vesicles. Also he thinks if the epididymis is the primary focus of genital tuberculosis, then isolated tuberculosis of the testicle should be met with more often than isolated tuberculosis of the seminal vesicles and prostate, but that this is not it. He concludes by remarking that whoever wishes to argue in favor of simple castration for genital tuberculosis should collect cases in which individuals so operated upon will show no tuberculous changes after death.

To these arguments Kraemer replies with renewed vigor. He says it is useless to deny the report of many able surgeons that clinical cure is established in 80 per cent of cases and to place against this indisputable evidence only 20 cases which were seen at autopsy. He thinks that the very fact that Simmonds himself cannot explain his findings is proof that his argument cannot hold water.

More recently Young (7) in a remarkably able and complete article comes out with the assertion that genital tuberculosis arises not in the epididymis, nor in the prostate, but in the seminal vesicle!

Out of this welter of disagreement what are we to believe? In the first place it is clear that those who have studied this question experimentally, clinically and anatomically are still uncertain as to the actual facts. In an experience of several years in the study of this problem I have found the most perplexing and conflicting evidence both clinical and anatomical. While I still believe that the great weight of evidence favors the origin of genital tuberculosis in the epididymis, I am willing to believe that in certain instances the primary focus may lie in the prostate, possibly even in the seminal vesicle. It is impossible to take up and discuss seriatim and ad infinitum the arguments of the various proponents of each point of origin, more especially those of Young. One can only make generalizations.

If genital tuberculosis arises in the prostate or even in the seminal vesical why is it that this disease is practically unknown clinically or post-mortem? It is only reasonable to suppose that tuberculosis of either of these organs would produce symptoms for which relief would be sought and treatment given. Furthermore prolonged observation of such cases would undoubtedly reveal the actual condition sooner or later. It is also true that in not a few instances autopsy has shown tuberculosis of almost every organ in the body, the prostate or seminal vesicles alone being spared.

If the prostate or seminal vesical is the starting point of epididymal tuberculosis why is it that the removal of the epididymis has such a salutary effect upon the other organs of the genital tract? I have followed a good many cases for a good many years both before and after operation. While there have been occasional exceptions, as is to be expected, the prostate and vesicles which were nodular, indurated and enlarged before epididymectomy have eventually returned to an essentially normal condition. It is probably true that while the microscope would still show evidence of tuberculosis in some, it is equally true that fibrous changes eventually occur and a clinical and permanent cure is established. This statement is not a case of the wish being father to the thought, but is an actual statement of fact.

In this connection one cannot avoid touching upon the subject of treatment. The results just mentioned have occurred after epididymectomy or orchidectomy, yet there are those, of whom Young is the most recent and ardent, who urge the desirability of and the necessity for the removal of the entire genital tract. While this operation certainly gives free scope to the skill, patience and ingenuity of the surgeon it apparently does not seem to afford an equal amount of satisfaction to the patient and after all, surgery should have this as one of its objects. If the prostate will quiet down spontaneously by a simple procedure why remove the prostate? Also is it not against all surgical principles for a primary focus to subside after the removal of a secondary focus. Why not remove the entire ureter and the bladder as well as the kidney in treating renal tuberculosis? The

procedure would be quite as logical. Or why not cure cancer of the breast by dissecting out the glands in the axilla?

If the primary focus lies in the prostate or seminal vesicle why are these organs less frequently attacked in children than in adults? Yet this seems to be the fact judging from my own experience and from the reports in the literature.

The radical operation of removing the entire genital tract is thought to reduce the immediate as well as the ultimate mortality? Does it do so? In the past ten years over 100 cases of genital tuberculosis have been admitted to the genito-urinary service of the Massachusetts General Hospital. All but a few have had either epididymectomy or orchidectomy performed. There has been one death in the hospital in this time and this case was unoperated. It would not appear, therefore, that conservative surgery involved a high death-rate. It is true that the ultimate deaths from tuberculosis are high and that at least ten years must elapse before the danger of dying from tuberculosis is past. Many of the deaths are from lung or general miliary tuberculosis. The radical surgeons claim that this high mortality is due to the tuberculous genitals which the conservative surgeons leave behind, yet they have presented no evidence that this mortality did not arise quite as much from the original process in the lung or other organs which induced the genital tuberculosis, as from the genital tuberculosis itself.

Furthermore, few if any, of their cases have been followed a sufficient length of time to show what the outcome will be. Certainly the results reported by Whiteside (8) are far from encouraging.

The foregoing discussion may not be entirely irrelevant to the subject of genital tuberculosis in children. It has been shown that these little patients are somewhat differently affected than are the adults but after all their hematogenous and lymphatic channels are the same, they are equally susceptible if not more so than adults to infection, and yet the prostate and seminal vesicles still in a state of inactivity do not seem to be as frequently affected by tuberculosis as do the adult's organs.

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CALCIFICATION OF THE SEMINAL VESICLES

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Clinical interest in the subject of calcification of the seminal vesicles is apparently not very great, as evidenced by the scarcity of literature on this subject. As a matter of fact I have been able to find only a few articles dealing with this topic.

The men who would naturally be most interested in this subject would be the pathologists, genito-urinary surgeons, and the roentgenologists yet in textbooks on pathology the subject is briefly dismissed with the statement that calcification in the seminal vesicles does occur, and its possibility is merely mentioned in textbooks on genito-urinary surgery. Moreover, a casual review of the roentgen-ray literature yielded nothing. Prompted by this fact a personal communication was sent to several roentgenologists asking them for information on this subject. However, the following roentgenologists had never met with this condition: Blaine, Carman, Hartung, Holmes, Manges, Pancoast, Reynolds, Trostler and Waters. On the other hand, Braasch stated that he had seen shadows in the roentgenogram on several occasions which were caused by calcified areas in the tuberculous prostate and seminal vesicles; Pfahler, that he had demonstrated calcification in the vesicles only in 3 or 4 cases which he can recall; and Skinner, that he had seen a few cases. Potter informed me that he had seen small nodular calcifications in cases of genito-urinary tuberculosis which from their distribution suggested they occupied positions in the vesicles.

A case under recent observation merits report for the following reasons:

1. Extensive calcification of one seminal vesicle.
2. The age of the patient (fourteen years).

3. Problem of diagnosis.
4. The rare occurrence of this condition.

Robert E., aged fourteen. In July, 1919 a suprapubic cystotomy for stone in the bladder was performed but no stone found. A diagnosis of stone in the ureter was made and the boy's father was told by the surgeon that he had crushed the stone with his fingers and that the fragments would pass.

The suprapubic wound failed to close, discharging clear urine, as a rule but at intervals pus.

Frequency of urination was present for several years, the patient being obliged to void many times during the day. There was no nocturia but the suprapubic pad was saturated with urine in the morning. Occasionally a few drops of blood were seen in the urine and the abdominal pad showed blood stains. There was a small amount of discomfort in the left side.

Physical examination was negative except for the presence of a slightly enlarged right kidney. Left kidney was not palpable. In the suprapubic area was a scar from his previous operation and in the lower angle of this scar was the opening of his suprapubic fistula, from which urine was being discharged.

Examination of the urine showed albumin positive; no sugar; microscopically, pus cells, red blood cells and bacteria. Examination of the first specimen for tubercle bacilli was negative.

Roentgen-ray examination by Dr. H. E. Potter showed the presence of an elongated, moderately dense shadow about 1 by 3 cm. in the lower pelvic region on the left side. From its position and contour it was believed that the shadow was *not* due to a stone in the ureter. A diagnosis of stone in the ureter having been made previous to patient coming under observation, it was thought advisable to cystoscope him, catheterize the ureters with shadowgraph catheters, and take a second roentgenogram in order to determine, if possible, the origin of the shadow seen on the plain plate.

Cystoscopy showed a mild generalized cystitis. During cystoscopy there was much bleeding. Left ureteral orifice was dilated. Examination of the urines showed the following:

	CELLS	CULTURES	TUBERCULOSIS
Bladder	2,560	Staphylococci	Negative
Left kidney	23,000	Sterile	Negative
Right kidney	90	Staphylococci	Negative

Roentgen-rays. The shadowgraph catheter apparently laid in contact with the shadow under consideration (fig. 1). Nevertheless, there being no justification for assuming that this shadow was due to a stone in the ureter, a rectal examination was done with the shadowgraph catheter in place.

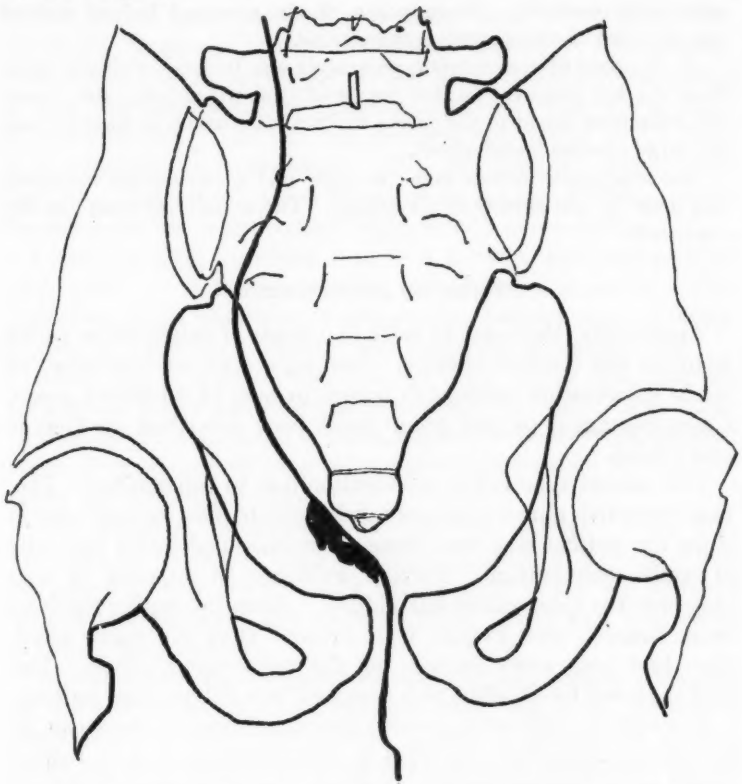

FIG. 1. CALCIFIED SEMINAL VESICLE AND SHADOWGRAPH CATHETER
The catheter apparently lies in contact with the shadow of the vesicle but a definite interval between the two could be felt on rectal examination.

Rectal examination. Left seminal vesicle was hard in outline, irregular, and corresponded in outline with the shadow seen on the X-ray plate Palpation showed that a definite interval existed between this hard calcified seminal vesicle and the shadowgraph catheter.

Repeated examinations were made for tubercle bacilli in the urine from the left kidney and all were negative. A diagnosis of pus kidney probably tuberculous, was made and nephrectomy advised.

Operation (*January 17, 1920*). Left nephrectomy was carried out under ether. Ureter was thickened and enlarged. Patient made an uneventful recovery. Examination of the removed kidney showed the presence of tuberculous pyonephrosis.

At the time of cystoscopy a guinea-pig was injected with the urine from the left kidney. In due course of time an autopsy was done; tubercles were found in the spleen and acid fast bacilli in the pus from the large caseous lymph-gland.

The suprapubic fistula failed to close and a subsequent operation was done for the closure of the fistula. The wound has remained dry ever since.

TYPES OF CALCIFICATION

Apparently, there are at least two types of calcification which occur in the seminal vesicles. One type may be designated as senile calcification because it occurs in men of advanced years. Cases belonging to this group have been described by George and Chiari.

The second type is the calcification due to tuberculosis. The, case reported above evidently belonged to this secondi group since the patient was too young to be classified under the type of senile calcification. Further evidence in support of this view was the tuberculous left kidney. From the replies received from Braasch and Potter, it is evident that the cases which they had seen were likewise of the tuberculous group. The case reported by Guelliot also occurred in a tuberculous patient.

It would be well to emphasize here that some of the cases of so-called calcification reported in the literature were in reality calculi in the seminal vesicle; in others, the calcification involved the vas deferens and not the seminal vesicle.

George reported 2 cases several years ago from Chiari's Pathological Institute in Prague. His first case was a male, aged sixty-three, in whom a diagnosis of endocarditis obliterans, gangrene of the first and second toes of the left foot, and trau-

matic tetanus had been made. The genital organs were without pathologic change except that in the wall of the mesial part of the inferior third of the right seminal vesicle, near the right vas deferens, an oval-shaped mass of bone-like consistence was found. The author stated that it seemed to be a lime salt infiltration.

The second case occurred in a man, aged fifty-three. The anatomic diagnosis was anal fistula, probably tuberculous, peritonitis, icterus, softening of the brain, healed tuberculosis of the lung, peribronchial lymph-glands and tuberculous ulcer of the intestine. The left vas deferens was found to be hard and bone-like in consistence. The left seminal vesicle was normal. The author called attention to the fact that the calcification occurred in connection with chronic inflammation.

Chiari, in 1903, reported a case in a male, aged sixty-eight, who died of lobar pneumonia and chronic nephritis. The ampullae of the vas deferens and seminal vesicles were of stony hardness, hence their removal was attended with difficulty.

According to Chiari, the foci involved chiefly the sclerotic connective tissue and he regards this case as one of focal calcification of the muscularis of the ampullae of the vas deferens and seminal vesicle, developing in previous proliferation and sclerosis of the connective tissue.

Two cases of calcification of the vas deferens were also reported at the same time by Chiari in men of fifty-eight and seventy-five. At autopsy only the ampulla of the vas deferens was found calcified, the vesicles being *intact* and the other genital organs normal.

Fraenkel likewise has reported cases of calcification occurring in the vas deferens. The patients were forty-five, sixty-two, sixty and fifty-four, respectively. Three of his 4 cases showed evidence of arteriosclerosis, such as areas of atheroma in the coronary arteries and the aorta. These cases were found at autopsy. Roentgen-ray pictures were made of the pelvic organs taken out in toto. The illustrations as given showed very distinctly the presence of calcification of the vasa deferentiae. In

one instance the calcification was more pronounced than it was in the other. The seminal vesicles were not involved.

Chetwood operated upon one case supposed to be tuberculosis and discovered that the calcification definitely involved both the seminal vesicles and the prostate. The case was one of very old protracted inflammation involving the prostate, seminal vesicles and adjacent tissues.

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DISCUSSION

Dr. RANDALL: I had occasion some years ago to have to postpone an operation on a case of tuberculous epididymitis because the family advisor a specialist in tuberculosis, feared the possible sequence of tuberculous meningitis: last year I did such an operation upon another patient, a boy of eighteen years and though the vas was not handled any more than clamping and cutting, for I did a complete orchidectomy, he developed fourteen days postoperatively severe headache and other meningeal symptoms, and after a period of some six months finally died with a persistence of these symptoms to the end. I would like to ask Dr. Barney if such a complication is a frequent follower of epididymal tuberculosis in his experience, or in the literature, for this occurrence in the latter case, immediately brought to my mind the suspicion in the former, though at the time I gave it but little credence.

Dr. BUGBEE: Confirming the remarks of Dr. Randall, I have recently seen a boy of sixteen with epididymitis which appeared to be tuberculous and proved to be so on the removal of the epididymis. Immediately following the operation he developed severe headaches. In this case undoubtedly he had meningeal complications as well.

Dr. CROSBIE: Personally I have always been averse to epididymectomy in cases of tuberculous epididymitis, It always seemed to me to be a half way measure. The infection is nearly always primary in the prostate and vesicles and the epididymis becomes secondarily involved as in gonorrhoeal infection. What can be gained by removing the secondary focus and leaving the primary? I was interested in hearing Dr. Randall and Dr. Bugbee both speak of complications following immediately after epididymectomy.

I have seen miliary tuberculosis and tuberculous meningitis follow pretty soon after epididymectomy. I think the radical operation is the thing to do if you are going to do anything. I have always treated tuberculous epididymitis by hygienic measures. Of course, the results are not particulary good, but it seems to me they do better than those who have had the epididymis removed. I think it will be necessary to follow cases, that have had the radical operation done, over a period of several years before we can feel sure that it is a wise procedure.

Dr. QUINBY: I cannot add anything to this interesting discussion of Dr. Barney's paper except to state that I have not in any way changed my attitude, taken now about four years ago. If you will remember, in my original remarks I stated that by this more extensive operation my endeavor was in large measure to find out what the sequence of tuberculosis in the genito-urinary tract was. I have not yet found a patient showing tuberculosis of the epididymis in whom tuberculosis cannot be demonstrated either in the ampulla of the vas, the vesicle, or the prostate. I would call Dr. Barney's attention to the fact that no examining surgeon is able to tell by rectal palpation whether there be tuberculosis in the vesicles or prostate, or not. Instead of causing a suppurative process in these more central organs, as it does in the epididymis, the reaction is frequently one of partial fibrosis, and under these circumstances only examination under the microscope is adequate to prove the presence or absence of tubercle. Furthermore, I am told by authorities on pathology that it is an exceedingly difficult thing to determine from a histological slide the age of a tuberculous lesion, except when it is found in its incipiency. My first patient shown at the meeting of the Boston Branch of the American Urological Association, was entirely well at that time, four years after operation. He is still well.

Dr. BARNEY (closing): I feel very much gratified and flattered that the subject of my paper should have brought out so much discussion.

In reply to Dr. Randall's question I may say that tuberculous

meningitis is a not uncommon cause of death in these cases. Out of 401 admissions at the Massachusetts General Hospital with a diagnosis of tuberculous epididymitis from 1872 to date, there have been but 8 deaths in the hospital, a mortality of 1.99 per cent. During the ten years of the existence of the genito-urinary service we have not had a death out of over 100 cases. The child, whose case is narrated in my paper, died unoperated while in the Children's Medical Service. It would not appear, therefore, that the operative procedures which we have employed are especially lethal.

In reply to Dr. Townsend's question the abscess about which he asked was in no way connected with the vas deferens and the child was not operated upon for the epididymal lesion. The abscess was near and apparently connected with the umbilicus. I have seen abscesses arise from the stump of the vas after operation in a few instances. In some cases this abscess eventually was taken care of by resolution; in others it was drained with eventual closure of the wound. In regard to fistula after operation I may say that I have seen none whatever in the groin and only an occasional one in the scrotum. I think these fortunate results are entirely to be attributed to the operation which we have performed upon these cases and which was described by Dr. Hugh Cabot and myself some years ago.

In reply to Dr. Quinby I may say that I have already pointed out in various previous articles the ease and frequency with which small and centrally located tuberculous lesions of the prostate and seminal vesicles can be overlooked. I also have looked over the literature and have consulted several expert pathologists with a view to ascertaining whether one can tell the age of a tuberculous lesion by its appearance. I find that there are those who think it is possible to make this distinction. In one of the cases recited in this paper Dr. James Homer Wright was of the opinion that the lesion in the prostate undoubtedly antedated those of the epididymes.

In regard to Dr. Young's remarks it is fair to say that the ultimate mortality is bound to be high no matter what we do. I have followed a good many cases for a good many years after

operation, not by letter but by personal examination. I have no hesitation whatever in saying that after epididymectomy the prostate and seminal vesicles have resolved into comparatively normal but fibrous structures and have so remained over an indefinite period of time. They were different than when examined before operation. These statements are based upon fact, not upon theory or desire. The fact is that we do not follow up these cases carefully enough or for a long enough period of time. If and when they die of tuberculosis who is to say whether they died of the genital tuberculosis or of the activity of the focus which gave birth to these lesions?

MALIGNANT DISEASE OF THE ADRENALS WITH REPORT OF A CASE

H. G. FULLER

Preliminary to reporting a case of this kind it would not seem out of place to include a brief review of the literature. The adrenal glands, although described as early as 1563 by Eustachius, did not command interest of clinicians and pathologists until 1885 when Addison presented a paper on local effects of diseases of suprarenal capsules. Since then much has been learned as to the function and diseases of these glands. However there is yet a lack of clear understanding regarding clinical manifestations of the adrenal tissues and the results of surgical intervention. Clinical manifestations of malignant tumors of the suprarenal glands are by no means pathognomonic. This condition presents only "a pathology" as a majority reach the autopsy table with scarcely other than a provisional diagnosis.

Necropsy presents to the pathologist interesting difficult and diversified subjects for his study. In addition to benign tumors, which occur in the greatest variety, we find true carcinomas and sarcomas, the latter malignant growths, presenting many peculiarities in their growth and cellular pattern. Often it is difficult to tell whether we have a case of sarcoma, a cancer with perivascular growth, or a true perithelioma, etc. These various forms are usually classed as malignant hypernephroma.

As previously intimated, difficulties of preoperative diagnosis are very obvious, there being no clinical evidence to guide us. Most especially is this true wherever we have metastasis, as these are almost certain to dominate the clinical picture. The surgeon usually performs an exploratory operation holding in

mind as a diagnosis, tumor of the abdomen, retro-peritoneal tumor, cholelithiasis, etc.

A real diagnostic certainty being quite the exception, even when a tumor is palpable it is apt to be confused with "perirenal abscess" growth of the kidney, gall-bladder, spleen, liver, etc. The commonest mistake is renal tumor from which it is extremely difficult to differentiate on account of the relation of the peritoneum to these two organs. Especially is this difficult if, as is so often the case, the tumor has invaded the kidney or become firmly attached to it.

To be sure ever present aids in the differential diagnosis are the urinalyses and pyelography. Attacks of pain especially of diagnostic importance are located in the hypochondrium and lumbar regions due to pressure on the first, second and third lumbar nerves and their branches.

Mayo Robson emphasizes shoulder pain in the sympotomatology, thought to be due to irritation of a branch of the phrenic nerve. Others disagreeing, attribute this to metastases of the scapula. There seems to be no relation between Addison's disease and tumor of the gland.

Blackburn (1) reported in 1906 an interesting case of round cell sarcoma with tendency to alveolar arrangement. Here the symptoms were rather characteristic of adrenal tumor though insufficient for diagnosis in the absence of palpable tumor. The indefinite pain was present but it could not be located or elicited by abdominal palpation. The autopsy here revealed primary melanotic sarcoma of the right adrenal with most extensive metastases.

Of primary malignant tumors, those commonly recognized are sarcoma in various forms and carcinoma. Also malignant hypernephroma and, according to Prudden, certain vascular and hemorrhagic adenomas. The sarcoma is said to be much the more frequent.

Primary sarcoma must originate in the connective tissue or the epithelium of the gland. The latter is of mesodermic origin and histogenetically capable of forming a sarcoma. If carcinoma be derived from the adrenal it must originate from

epithelial elements while connective tissue forms its stroma, or from misplaced tissue of other blastodermic layers.

According to Carl Winkler (2) and Herxheimer, primary sarcomas of the suprarenal glands are very rare. Cases of spindle cell sarcoma, angio-sarcoma, round cell sarcoma, melano-sarcoma, lympho-sarcoma, etc., have been reported. Under the last title certain cases have been recorded which now would no longer be considered as sarcoma but would be regarded as tumors originating from the medullary portion of the gland and its specific cells, and would be treated as a tumor under the title of "Neuroblastoma sympathicum."

The first operations for extirpation of malignant tumors of the adrenals were done in 1885–1886 by Gussenbauer, Morris, Herff and Nicoladoni Wendal in 1904 collected twenty-four cases of tumor from the literature, all being treated surgically. The immediate mortality was 50 per cent and only six cases were followed by recovery lasting from six months to six years.

CASE REPORT

Male. Age forty-two. Occupation, builder. Family history negative. Previous history negative unless an accident last July, described as a landslide in which he was caught but to which he did not pay any attention at the time, might have had some bearing on subsequent events. Patient's last illness began September 1, 1920, with pain in the left side, located in the chest and extending around to the back. Regarded as being a pleurisy or some similar ailment for which chest was strapped. Patient then left the city, visiting a number of physicians during the next month without relief.

About October 1, an X-ray was made especially confined to the chest with a report showing enlargement of the aorta. It was suggested that a Wassermann be taken, which was negative. He was advised to go to bed for six weeks being put on potassium iodide. Pain increased in severity and on November 2, a large dose of morphine was given to control pain. Examination at this time showed dullness of left chest, up to fourth rib, absent breath sounds with fixed chest wall and tenderness over left kidney.

Sent to hospital and X-rayed the next day, the patient being carried directly from the ambulance to the X-ray room, the roentgenologist

being told the patient was thought to have empyema. First the patient was fluoroscoped which revealed that it was not a chest condition but an intra-abdominal trouble of some character. The next day he was X-rayed to learn of any kidney lesion. This showed clearly the presence of a large mass apparently below the diaphragm on the left side with what seemed to be a large stone or similar dense shadow near the center.

We were asked to see him at this juncture. Ureteral catheterization on November 4, showed negative kidney findings. Further X-ray examination with X-ray catheter in place showed same shadow but presumably not located in the kidney, in fact stereoscopic plates demonstrated a shadow showing posterior to the kidney. Dr. Merritt, roentgenologist, November 6, 1920, reported mass above left kidney elevating diaphragm and interfering materially with respiration of left lung. There is a calcified mass of considerable size, posterior to the kidney and on same level.

Examination by pneomoperitoneum, plate three on belly and plate four on right side, points definitely to the presence of a mass above the left kidney which does not separate from the left diaphragm and cannot be differentiated from the left kidney shadow apparently blending with it, regarded as being an abscess or new growth. The chest plate number two shows elevation of left diaphragm and decreased radiability of left lung but no evidence of disease of the lung.

All urinary examinations practically negative. Leucocyte count on admission 9000, lymphocytes 8 per cent, transitional 3 per cent, Polynuclear: Neutrophiles 89 per cent.

The one predominating symptom throughout his whole illness, especially after entering hospital, was severe unendurable pain and I might say especially referable to the posterior extending to the scapular.

The temperature up to this time was not over 100°. On November 8, we decided to operate, many diagnosticians having been given the opportunity to render a diagnosis. The best minds wavering between peri-nephritic abscess and new growth, presumably of the adrenal, the greatest leaning being toward the latter diagnosis.

A lumbar incision was made and a tumor mass was exposed, apparently springing from the upper pole of the kidney, extending upward and backward, displacing the diaphragm. The mass was distinctly above and non-adherent to the kidney structure presenting all typical and unmistakable physical characteristics of malignant growth of the left adrenal.

The large calcareous mass shown in the X-ray was located at the median and lower side of the mass. This was, with little difficulty, removed. The extent and adhesions on all sides of new growth together with its friability gave very definite evidence of the lack of wisdom of further operative procedure. So, after removing the calcareous area with portions of new growth for sections, the incision was closed, a large tube being inserted for drainage.

Maximum temperature up to November 16th was 101.4°, the 16th to the 22nd fluctuated between 102° and 98.6°. Patient steadily lost ground, dying on December 3.

We were fortunate in securing a post-mortem, a detailed report of which is included. I will read that referable to the pathological condition at issue, being confined to the large retro-peritoneal sac including the site of the left adrenal, there being found no evidence of metastasis anywhere.

Advantage of the size of the tube was made use of in after treatment for inserting a capsule of 100 mgm. of radium which was used three times. Patient steadily grew worse and I might say a few days before death developed a gastric fistula.

Report of examination of tissue removed at operation

Microscopic examination shows a fairly uniform mass of large cells with large nuclei, varying from round to oval. There are a number of very large cells with very large nuclei, some with multiple nuclei, and mitotic figures are seen.

Diagnosis: large round cell sarcoma.

A large bone-like mass taken from the region of the tumor is found to be completely soluble in hydrochloric acid and absolute alcohol. It is evidently a calcareous deposit.

Report of post-mortem examination

Body is that of a very emaciated white man.

External: There is definite though moderate jaundice, noticed in the sclerae. There are a number of small, irregular, pigmented moles on the abdominal wall.

An open incision (operative) is observed in the back, left side, just below the costal border, in the infrascapular region.

On incision of the skin, a very small amount of subcutaneous fat is found, and this is of a deep yellow color. The muscles are poorly developed.

The chest: The pleurae are free of adhesions at all points, there is no fluid in the pleural cavities. The diaphragmatic pleura is smooth on both sides of the chest.

The heart is of normal size. There is a small amount of straw colored fluid in the pericardial sac. (Heart not opened.)

There is no evidence of the thymus and no enlargement of the bronchial glands.

The omentum is nearly free of fat. It is not adherent to the wall of the abdomen or the viscera at any point.

The liver is not enlarged, but is somewhat pale in color. The gall-bladder contains bile, which is readily expressed through the ducts on pressure. No gall-stones are found.

The stomach is normal in appearance anteriorly. There is no evidence of a tumor mass on palpation and the pylorus is patent. Posteriorly the stomach is found to communicate with a large retroperitoneal sac, which will be described below. There is no thickening of the walls of the stomach at this point, but the tissues are quite readily broken down on manipulation.

No pathological condition of the intestines is observed.

The pancreas appears normal.

The spleen is of about normal size and appearance. There are a few adhesions in the neighborhood of the retroperitoneal sac, to be described, involving the anterior portion of the spleen.

The right kidney is of normal side and appearance. The capsule strips readily. The adrenal is normal.

The left kidney is of the same size and appearance as the right, except that an area of about 5 cm. in diameter on the anterior surface is denuded of capsule at a point in contact with the peritoneal sac referred to.

On section both kidneys have a somewhat grayish and granular appearance, and show a moderate degree of congestion.

Extending upward from the left kidney to the stomach and including the site of the adrenal, there is a large retroperitoneal sac, containing a red-brown grumous material, with a number of masses of firmer, friable, white and yellowish white substance. This sac is found to be in communication with the stomach and to be connected with the operated incision in the left back. On clearing out the sac, the wall is found to be smooth in the region of the peritoneum, but there is considerable destruction of tissue, including muscle, posteriorly.

No tissue which can be recognized grossly as adrenal tissue can be found.

There is no enlargement of the abdominal glands.

Bladder normal.

Microscopic examination of portion of tissue from retroperitoneal sac: There are areas of necrosis with large areas of fibrous and vascular network thickly interspersed with groups and masses of cells varying in size and shape. Many of these cells are suggestive of an epithelial type, others are of a round or spindle connective tissue type. Mitotic figures are seen and there are a number of very large cells with unusually large nuclei and some with multiple nuclei.

Anatomical diagnosis: Multiple pigmented moles. Small pericardial effusion. Retroperitoneal sarcoma (with degeneration), mixed cell type. Perforation of stomach. Mild degree of nephritis (not confirmed by microscopic examination).

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DISCUSSION

DR. QUINBY: The extremely interesting case which Dr. Fuller has reported represents one type of tumor occurring in the adrenal gland. The case reported by Dr. MacKenzie illustrates the other type. In other words there are two varieties of tumor arising from the adrenal gland which are entirely different, not only in their histology but also in the clinical manifestations which they cause. The variety described by Dr. MacKenzie is known as the typical adrenal cortical tumor, and in as much as the adrenal in its developmental stages bears close relation to the sex gland, these tumors are most frequently found to carry with them clinical manifestations of abnormality in regard to the secondary sexual characteristics. Especially frequent is precocious puberty and so striking is this that such cases are found in the literature under the caption of "Infant Hercules." In the female sex they lead to precocious menstruation. While I was with Dr. Young in Baltimore, I had the opportunity to study a case occurring on the Gynecological Service of the Johns Hopkins Hospital, in which a tumor of the adrenal cortex occurring in a little negro girl of seven, had caused the early appearance of all changes associated with puberty. These adrenal cortical tumors are exceedingly interesting and have been very well described in an article by Glynn in the *Quarterly Journal of Medicine*, about six years ago.

The tumor described by Dr. Fuller is of quite a different type, and originates in the medulla of the adrenal gland. It is of embryonic type, taking origin in the primary adrenal blastema. I have seen one striking instance of this type of tumor which, interestingly enough, involved both adrenal glands. It occurred in a man just over fifty years of age who was referred to me for urological investigation. There was no abnormality in the urinary tract. His history was exceedingly interesting. Starting as a very vigorous individual who, while in college, rowed on

the crew and was active in athletics generally, he continued his physical activities, entered the lumber business in the West, made a fortune, and returned to the East to locate about ten or twelve miles from Boston. Here it had been his habit to walk daily to and from his office in the city. Suddenly, from being a very aggressive, physically active, individual, he changed, lost weight, and became also entirely different mentally. Life had no further interest for him; he became apathetic and apprehensive. On physical examination he had an abnormally low blood pressure, but other than this there was no outstanding feature of note. Looking back on the case, however, it was easy to see that he had in large measure assumed the condition seen in the laboratory in animals from whom both adrenal glands had been removed, and also the condition seen in Addison's disease. This condition has been described by the French writers as, "sydrome surrenale," and is characterized by extreme flaccidity of all the musculature of the body with loss of tonus. Subsequently this man developed a palpable tumor in each loin and shortly thereafter died. Autopsy showed bilateral tumors of each adrenal gland of the type which Dr. Fuller has shown.

Dr. FULLER: This case has been a tremendously interesting one to me and I enjoyed very much the discussion which was most interesting. I do not think there is anything to add to what has been said.

TROPICAL INGUINAL GRANULOMA IN THE EASTERN UNITED STATES

ALEXANDER RANDALL, JAMES C. SMALL AND WM. P. BELK

Philadelphia, Pennsylvania

We wish in a preliminary report to briefly call your attention to a condition supposedly occurring only in the tropics, and its endemic existence in the temperate parts of the eastern United States.

Under the following variety of names: tropical inguinal granuloma, tropical ulcer, venereal granuloma, granuloma inguinale, and granuloma pudendi, there has long been recognized by physicians practising in the tropics and especially in South America a disease which was supposedly limited to these countries.

Last year Symmers and Frost reported from the laboratories of the Bellevue Hospital, New York, two cases of tropical inguinal granuloma found in negroes of that city, and this number has recently been augmented in a later report by Campbell of three further cases found in the urological wards of that institution.

Recognizing the similarity of the lesions, as illustrated by Symmers and Frost, to certain cases that have been repeatedly seen on the urological service of the Philadelphia General Hospital, a round-up was instituted on commencing the service January 1 with the result that 5 men and 2 women were found, in the institution suffering from this condition. These numbers have been increased since that time by 3 men and one woman patient, making a total of 11 cases under observation. Four further cases have been reported to us: one an inmate of the Penitentiary who had on two previous occasions been treated

for this condition at the Philadelphia General Hospital; a second and a third, observed by Dr. A. H. Lippincott of Camden, New Jersey, after being diagnosed by our laboratory; and a fourth, a native of New Jersey who is awaiting hospital admission having been referred by Dr. J. L. Herman: a total of 15 cases.

The first and most important fact, when making such a diagnosis of a supposedly tropical disease as present in the temperate zone, is the unquestioned accuracy of the diagnosis. We have turned to the work of Aragao and Vianna of Rio Janeiro, who are probably the world's authorities on this condition, and the originators of the specific antimony treatment, and we have been able to corroborate and substantiate in our cases all the bacteriological data that they report, while the result of the specific treatment, and the similarity of the appearance of the lesions, as we have seen them, to the splendid photographic and colored illustrations in their work have alone been almost self-substantiating.

This disease has been present, practically constantly, in the Philadelphia General Hospital as long as any of the attending physicians and nurses can remember. It has masqueraded both here as elsewhere, under various other diagnoses, among which may be mentioned lues, now ruled out as in fact it has always been, by the repeatedly negative blood tests, lack of specific history and absolutely negative results with arsenic therapy; as chancroidal infection, to which it rarely bears any similarity as destructive ulceration is particularly not a characteristic; as tuberculosis, though never substantiated by microscopic study; as condylomata, to which when seen in the female or about the anal region it bears a close similarity; and as carcinoma, to which the microscopic picture in two of our cases was almost typical.

HISTOLOGICAL RECORD OF INGUINAL GRANULOMA[1]

Four cases: 2, 11, 6, 7. Tissues were fixed twenty-four hours in formalin; sections were cut from paraffin blocks and stained with hematoxylin and eosin.

[1] By Dr. William P. Belk.

The general appearance of the four was the same. There was a proliferation of fibrous tissue, moderate in amount, and enormous numbers of polymorphonuclear leucocytes and endothelial cells. Some times one, sometimes the other predominated. The vessel walls were somewhat thickened, as in chronic inflammatory processes. There was in every case some proliferation of the squamous epithelial cells of the skin; in no. 7 this was quite marked, and in no. 6 proliferation was so marked and extended so deeply that a preliminary diagnosis of epithelioma was made. There was in some cases, slight amount of necrosis, but this was never marked, nor was abscess formation noted. The process was separated from normal tissue by bands of connective tissue.

Sections from two rabbits autopsied. Rabbit 3 and rabbit 5 showed identical histological pictures. In these cases, the infecting organism was stained in the tissues by the following method: six hours fixation in Sheuder's solution, 1 hour in Giemsa stain, otherwise technique as ordinarily recommended for Giemsa.

BACTERIOLOGICAL METHODS AND LABORATORY DIAGNOSIS[2]

Direct smears

Direct smears from the lesions, properly prepared and stained, constitute a very reliable method of diagnosis. The material may be collected on sterile cotton applicators for either the smears or the cultures. Thin spreads of this material are essential. These are dried quickly in air and stained either by Wright's, or Geimsa's stain. Wright's method is the more rapid and has given satisfactory results. The most difficult part of the procedure is to obtain the proper differentiation of the stained smear in distilled water. Even with the most intense Wright's staining this differentiation should not be carried on for more than fifteen or twenty seconds. Application of the water for too long entirely decolorizes the capsules of the organisms: for too short a period, the capsules appear blue and the morphology of the bodies of the organisms cannot be observed clearly. With the best staining results, the organisms appear as small rounded pink bodies with a dark blue coccoid body in the center; or, more frequently, as oval pink bodies with a bacillary, or diplococcoid body occupying the longitudinal axis. The pink outer zone is a wide bacillary capsule; the dark blue central bodies represent metachromatic granules within

[2] By Dr. James C. Small.

the bacillary body proper. The true outline of the bacillary body can be seen only after the capsule has been entirely decolorized by differentiating with distilled water. In stained smears from the lesions, some areas show organisms with capsules stained pale blue and obscurely differentiated central bodies; other areas show well defined dark blue metachromatic granules surrounded by a pink capsule, which latter, however, obscures the outline of the bacillus proper; and still other areas are seen in which the capsules have been entirely unstained and where the organisms appear as short, thick bacilli with rounded blunt ends occupied by the dark blue metachromatic granules. The organisms thus present a true bipolar-stained appearance with the intervening body shaft of the bacillus stained a pale blue. Always a few bacilli, shorter than those just described, stain solidly a deep blue.

The organisms are found within the cytoplasm of large mononuculear cells. In such they have well defined capsules, or may appear as nests. of bacteria occupying a rounded area within the cell and revealing no capsules. In such nests the bipolar staining may be observed. The polymorphonuclear leucocytes do not contain encapsulated forms. Encapsulated forms may appear free, or in relation to cellular detritus. In the latter instances they occur chiefly in groups and in the neighborhood of large naked mononuclears. These presumably represent organisms released from the disintegrated cytoplasm of mononuclear cells. In the former instances they may occur singly and in no relation to cellular detritus.

Smears from the lesions are remarkaby sparse in bacteria, as compared with smear preparations from other types of ulcerative lesions about the genitalia. Staphylococci, streptococci, diphtheroid bacilli and bacilli having the morphology and staining character of the colon group have been observed widely scattered, or in small clumps within the polymorphonuclear cells.

Cultures

The granuloma organisms have been grown in cultures in four instances. Of the various media and methods tried, surface inoculation of Sabaraud's maltose agar (2 per cent acid), as recommended by Aragao and Vianna, proved the most useful. This degree of acidity tends to inhibit some of the contaminating bacteria, and permits profuse growth of the granuloma bacillus. The growth is quite characteristic after twenty-four hours incubation. Colonies appear slightly gray white,

moist, glistening, dome shaped on round regular basis from 1 to 3 mm. in diameter. When touched with an inoculating wire they appear quite viscid and have the consistence and appearance of thin starch paste. By transmitted light they are translucent and have a slight brownish tinge. They are usually the largest colony appearing in these mixed cultures of the material taken directly from the lesions, and are very readily recognized.

In subcultures growth occurs on all of the simpler media. Enriched media is not necessary, on semisolid media the character of the growths does not differ essentially from that described above. In fluid media there is diffuse turbidity with a surface ring tending to adhere to the sides of the culture tube and to climb slightly above the level of the liquid. Later sedimentation occurs. Growth is profuse even in 1 per cent peptone water. In litmus milk there is acid production and coagulation within twenty-four hours. On potato growth is profuse, moist and sightly brownish in color. There is a decided blackening of the potato.

Smears from cultures, when stained with Wright's stain, show essentially the morphologic details previously described; in smears from Sabaraud's media and from moist glucose or plain agar, wide capsules are readily demonstrated, so that the organisms appear as do the encapsulated ones in direct smears from the lesions. In smears from broth cultures, capsules are not demonstrated, so that the organisms from twenty-four hour old cultures appear as short, plump bacilli exhibiting irregular staining—for the most part showing a dark area at either pole with pale blue intervening. In older cultures, especially in media containing a carbohydrate which has been fermented with decided acid production, long forms occur. These forms also stain irregularly, presenting dark blue banded areas, alternating with pale blue areas throughout the length of the organism.

Our study of the organism may be tabulated briefly:

Non-motile, non-sporulent, encapsulated bacillus, Gram negative; showing metachromatic granules as well as capsules with Romanowski staining.

It does not liquefy gelatin, or coagulated serum.

It hemolyzes blood in agar plates.

It does not form indol.

Coagulates and acidifies milk within twenty-four hours.

It ferments dextrose, levulose, lactose, galactose, saccharose, malatose, arabinose, mannitol, salicin, inulin, and dextrin. It does not ferment dulcitol and rice starch.

Pathogenicity

Intraperitoneal inoculation kills white mice and guinea pigs in twenty-four to forty-eight hours. The organisms are recovered at autopsy from the peritoneal fluid, the blood and the various internal organs.

Cutaneous inoculations of white mice, guinea pigs, rabbits, cats and dogs all failed to produce definite lesions.

Intradermal inoculations of dogs were also negative.

Subcutaneous inoculation of white mice and guinea pigs produced an inflammatory reaction, going on to abscess formation in some instances but always with spontaneous and rapid healing. In dogs and cats no abscess formation occurred, only a slight inflammatory reaction being noted.

In rabbits it produced large subcutaneous infiltrations with abscess formation and spontaneous rupture producing ulcers some of which have failed to heal after an observation period of six weeks.

CLINICAL STUDY

Symptoms

The usual history is that the lesion started as a small papule, non-inflammatory, which after rupture and the exudation of a slightly purulent fluid, refused to heal, and exhibited progressive tendencies toward slow proliferation and spreading. The lesion in its purity (especially seen when involving the inguinal region), is a flesh-red, exuberant, overgrowth of soft granulation tissue. It has absolutely no simularity to an ulcer, with its eroding, undermining, necrotic base. The center of the granuloma appears slightly depressed, and there is certainly a destructive action present, but the edges are redundant and overlap the apparently healthy skin margin. Exudate is scant, mucoid in character, of a non-offensive odor, and when wiped with gauze is easily removed, leaving a clean blood-red surface, similar in every respect to a large area of healthy granulation tissue as seen in clean surgical wounds. This picture varies according to the duration, size and location. The older lesions show at times tendencies towards cicatrization at some points, while spreading in others, but this only occurs when flat non-

chafing surfaces are involved. Large lesions, especially those in the perineum, become bulbous, simulating condylomata acuminata, with large rounded heads of new growth, the heads ofttimes with pearly white surfaces of epithelization, and deep crypts with raw granulomatous surfaces. Secondary infection here causes the clean, odorless character to change.

As indicated by the name the most frequent location is in the groin spreading upward as far as the anterior superior spine and downward through the fold of the groin frequently involving the perineum, and in some cases following the fold of the nates and spreading to the buttocks. Prepucial lesions are likewise frequently associated and at times primary, and involvement here has given us the most destructive picture with a gradual erosion of the glans and even the shaft of the organ. In the female, the labia majora share the brunt of the attack with the perineum and groin involvement in some cases. We have had one case, a male, with the granuloma limited to a proliferative growth about the anus.

The patient has few subjective symptoms. They suffer no pain or discomfort unless the involved areas are so placed as to cause chafing. The granuloma is practically painless to the touch, and only deep pinching-up of the mass will cause suffering. Practically all of our patients have shown a definite degree of secondary anemia, but there has been a complete absence of pyrexia, chill, leucocytosis, throbbing, lassitude, or the usual concomitants of infectious processes.

Race

All of our cases, with one exception, have occurred in the negro. The one exception is that of a white male, in whom the lesion has likewise been atypical, simulating a phagodenic chancroidal sore with ragged ulcerated edges. His bacteriological examination was positive and he may be harboring a double infection. He, however, has not responded to treatment as in the others.

Diagnosis

We have based our clinical diagnosis entirely on the bacteriologic finding of the specific organism. This is done by making smears from the exuding surface, in which will be found numerous large mononuclear plasma cells, whose protoplasm, on proper staining, will be found studded with the characteristic encapsulated diplo-bacillus. The therapeutic result from the use of antimony intravenously, may likewise be taken as indicative of the accuracy of the diagnosis, for after three or four administrations the organism disappears entirely from the surface and cannot be found in smears.

Treatment

As pointed out by all previous writers and substantiated by the histories of cases in the Philadelphia General Hospital in years gone by, the treatment of these lesions has been most disappointing until the present, when antimony was first instituted.

Local applications of salves, escharotics, and antiseptics do no good whatsoever; vaccine therapy has been consistently a failure; excision is followed almost uniformly by recurrence before healing; arsenic is of no benefit; and X-ray alone has given us any curative results, causing a slow cicatrization, but because of the dangers associated with its use, it has been possible to apply it only once every three weeks, and therefore requiring on an average from twelve to eighteen months to establish healing. Even with X-ray the hospital experience in the years past has been disappointing, and probably at least 50 per cent of the cases had recurrences.

Some of our present cases have had two or more admissions in passing years for return of their lesions after apparent complete healing under X-ray therapy, while several have been so long inmates of the institution that they have been put on the hospital's pay-roll and work as laborers about the buildings.

Following Vianna's work, we started giving antimony intravenously in the form of tartar emetic. The initial dose of 0.04 gram was used, and this quickly advanced to a maximum dosage of 0.1 gram. Our first treatments were given daily and most

patients tolerated this until about ten doses had been given, but nearly all after that amount showed some symptoms of intolerance for the drug and we began intermitting the daily dosage, governing the time by symptomatic data. This intolerance consisted of rheumatoid pains in the joints associated with stiffness, especially seen in the early morning on rising, and most frequently located through the shoulder girdle, and as a general rule wearing off during the course of the day. There have not been in any case symptoms of an alarming character.

The drug has been prepared by dissolving 0.1 gram in 10 cc. of saline solution and is best put up and preserved by sealing, under sterile precautions in that size glass ampoules. Intravenous administration is essential.

The lesion becomes bacteriologically sterile after the second or third dose of the tartar emetic. Healing commences within forty-eight hours after the first administration, and from then on almost daily progress can be appreciated. Epithelial proliferation starts at the edges and rapidly spreads inward, while often isolated islets of epithelium in the midst of the granuloma, before not seen, or buried, start proliferation in the midst of the lesion and hurry the complete healing.

The phenomena of healing can best be pictured to you by comparing it to the use of salvarsan in somewhat similar long standing and untreated luetic skin lesions.

In some cases the administration of the drug causes a tingling, pricking sensation in the granuloma, immediately after the injection, and ofttimes an excess of mucoid secretion occurs for the first few days. Scabbing over of the surface takes place wherever the raw surfaces are in apposition, and thin crusts form around the periphery of open areas.

Results

Of our 11 personally observed cases, 8 are healed. As this is but a preliminary report we will omit history resume and tabulate them in the following table. Following the advice of Vianna we have persisted in giving all patients a course of injections after complete healing has been accomplished to prevent the possibility of recurrence.

NUMBER	NAME	SEX	ATTACK	DURATION	AREA INVOLVED	TREATMENT STARTED	CURED	DAYS	NUMBER OF DOSES	AMOUNT OF DRUG	FORMER TREATMENT, REMARKS
										gms.	
1	Henry J.	M.	Primary	3 years	Penis, left groin, and perineum	2/11/21	3/29/21	49	23	1.85	Healed
2	Harry Q.	M.	Primary	8 months	Prepuce, left groin and perineum	2/11/21	3/26/21	46	21	1.82	Healed
3	George J.	M.	Second	6 years	Right groin and perineum	2/11/21	3/2/21	19	20	1.07	X-ray and excision, healed
4	William H.	M.	Primary	2 years	Right groin and penis	2/11/21	2/23/21	17	13	0.82	X-ray, healed
5	William P.	M.	Second	15 months	Right groin and perineum	2/12/21	2/15/21	3	3	0.23	X-ray, stopped treatment and recurred 4/15/21, healed
6	William F.	M.	Primary	2 years	Anal	2/24/21	4/2/21	37	20	1.07	Healed
7	Benj. A.	M.	Second	2 months	Penile	3/23/21					Under treatment
8	Eliz. C.	F.	Second	2½ years	Vulva, thighs	2/11/21	4/22/21	39	29	1.90	Healed
9	Marie S.	F.	Third	3 years	Vulva, left groin	1/29/21	3/29/21	31	32	1.96	Healed
10	Florence R.	F.	Primary	5 months	Vulva, perineum						Under treatment
11	Francis J. D.	M.	Primary	2 months	Left groin, perineum	4/11/21					Under treatment
12	Carey B.	M.	Third	10 years	Right groin, penis, perineum and anal						3 hospital admissions, X-ray, awaiting treatment
13	Mabel W.	F.	Primary	1 year	Vulva, perineum	3/7/21	4/18/21	42	17	1.00	Healed
14	John D.	M.	Primary	9 months	Penis						Awaiting treatment

DISCUSSION

Dr. Ross: I thank you very much for the invitation to discuss Dr. Randall's paper. While in the Service at the Base Hospital, Camp Greene, there were mustered in a number of the colored troops from North Carolina, South Carolina and Tennessee, this particular disease was brought to my attention. I can recall in all some half dozen cases to which was applied most any diagnosis, but mostly that of syphilis. Some of these patients had positive Wassermanns, were given anti-syphilitic treatment, the blood would become negative, but the lesion would not improve. Others had negative Wassermanns but were given anti-syphilitic treatment just the same with no results. These patients were eventually given a surgeon's certificate of disability and discharged.

Upon becoming associated with Dr. Bryan at the Clinic of the Medical College of Virginia, I saw more of these cases and continued to study them with Dr. Driscoll who was then in the United States Public Health Service. Dr. Driscoll later published an article in the *Archives of Dermatology and Syphilis* on this subject and advanced the theory that the causative agent was a vibriosis of the fusiform and a spirochete such as is found in the fourth venereal disease. In the same journal, Dr. Goodman of New York writes upon apparently the same subject and has found the intracellular organism which Dr. Randall has cultivated. We are indebted very much to Dr. Randall for his work on this organism. We have not investigated the etiology as well as we should or as well as we hope to do but the pathology is so pathognomonic that we have relied upon it entirely for a diagnosis. The most striking feature about the subject is the marvelous results obtained by the use of tartar emetic solution intravenously. The disease which may have existed for as long a period as six or ten years and resisted all forms of treatment will clear up in a few weeks, a result that could hardly be

bettered by arsphenamine in a syphilitic lesion. We have had no bad results from the use of tartar emetic solution as reported, only a temporary emesis in some cases. We have never filtered the solution as recommended by Dr. Keyes.

Dr. MORTON: I would like to ask Dr. Randall how he uses the tartar emetic.

Dr. RANDALL (closing): The drug as first used by me I had prepared by a careful chemist who put it up in ampoules of 10 cc. each, but later we had the pharmacy of the hospital prepare it in flasks which we sterilized each day before using. We have had some reactions, consisting of rheumatoid pains in the long bones and especially about the shoulder girdle which are worse in the early morning and generally wear off promptly during the first hours after rising. We have had no trouble in keeping the patients for complete treatment because so many of them have had the condition for so long that they were only too lad to keep on now that they have for the first time received a form of treatment that has given such prompt results: some of the patients have been in and out of the hospital so many times for the same condition that three of them, I think it is, have been placed on the payroll of the institution so they could get their X-ray treatment every three weeks, and they have been a help in impressing the ones, that were in a hurry to leave, of the necessity to complete their treatment. I know of but one case in the literature of the disease in a white man, and that is reported from England as occurring in a white man long a resident of Rio Janeiro, and returning home with the condition present. Let me correct Dr. Keyes in reminding him that one of Dr. Symmer's patients was a native of Pennsylvania. Most of our patients are from our vicinity and with only two exceptions none have been south of Mason-Dixon Line.

There are many interesting problems associated with this recognition of a supposedly tropical disease in our northern clime: viz.,

It is undoubtedly endemic in our midst and unrecognized.

It is being treated under erroneous diagnoses.

It has a specific bacterial cause that is easy of demonstration. All forms of treatment are of no avail except antimony which acts as a specific.

Its mode of transmission has yet to be worked out and opens many attractive possibilities.

RENAL TUBERCULOSIS[1]

JOHN R. CAULK

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Tuberculosis of the kidney constitutes one of the important chapters of surgery and certainly one of extreme importance to the urologist, since about 30 per cent of all the surgical lesions of the kidney are tuberculous.

The statistics of Kronlein and Isreal bear this out. In my series it has been 22 per cent, that is, there have been 55 operations on the tuberculous kidney in 250 surgical operations upon this organ. This percentage in my cases has been due to two factors; 80 per cent of the patients, who were operated upon, had gone so long that both kidneys were involved and a more or less generalized tuberculosis had occurred, hence surgery was of no avail. The other 20 per cent were unilateral and typically operable, but would not submit to operation because they were advised, often by their physicians, to withold operation in order to see if medical treatment would not effect a cure. This idea is a very prevalent one and one which offers the most serious obstacle to the cure of early tuberculosis of the urinary tract.

There has never been in the history of medical literature a single authentic case of spontaneous healing of a tuberculous kidney. The ultimate outcome is always one of complete destruction to the kidney and usually severe mutilation to the rest of the urinary tract. So we are faced with the inevitable, and I warn against any hope for medical cure of renal tuberculosis and urge early nephrectomy, in order that the deleterious effects, which it is bound to produce and which I will describe later, may be prevented.

[1] Read before St. Louis Medical Society, April 5, 1921, and Medean Society, March 3, 1921, University Club Building.

By the introduction, retention and colonization of tubercle bacilli in the kidney, many types of morbid processes may develop. The French school classifies miliary tuberculosis, nodular tuberculosis, ulcero-cavernous tuberculosis, tuberculous pyonephrosis, tuberculous hydronephrosis and tuberculous nephritis. It seems satisfactory to consider three main types—acute, miliary, chronic or surgical and toxic tuberculous nephritis. It has been shown by Lorrison Brown and others, that tubercle bacilli may be excreted through healthy kidneys. Brown demonstrated that about 10 per cent of patients suffering with pulmonary tuberculosis, show tubercle bacilli in the urine without evidences of renal involvement. With lowered resistance and active processes, the kidneys may be showered with generalized tuberculous lesions which offer no hope for restoration of function or cure. Between these two extremes is chronic tuberculosis.

In this paper, I shall not consider the acute miliary type, since it is a part of generalized tuberculosis and offers no hope of surgical cure, nor shall I consume your time in discussing toxic tuberculous nephritis which may be either a part of general tuberculosis or secondary to a tuberculous mate. In the latter instance, the nephritis usually subsides after the removal of the tuberculous organ.

Our time shall be devoted to a consideration of the so-called chronic or surgical tuberculosis. This disease is usually a unilateral affair, primary in the kidney, as far as the urinary tract is concerned, but usually secondary to some other focus in the body such as the lung, bone, gland, bowel or genital tract. Kuster states that 10 per cent of patients dying of tuberculosis, have kidney involvement. In 85,000 operations at the Mayo Clinic 0.6 per cent were for renal tuberculosis. Kapsamer in 20,000 autopsies, found 191 cases of renal tuberculosis or little less than 1 per cent; of these 191 cases, 67 were unilateral and 124 bilateral. Of the bilateral cases, his findings indicated that a great majority showed old processes in one kidney and early in the other, illustrating that there had been unilateral involvement, but time had allowed the other kindey to become infected. Halle and Motz in 111 cases found 89 unilateral. Kuster in 68

cases found but 16 bilateral. Legueu states that bilateral tuberculosis of this type should not exceed 15 per cent. In my series 29 per cent were bilateral—in the unilateral 60 per cent were on the right side and 40 per cent on the left. Albarran, Isreal and Casper are of the same belief as Legueu. Therefore, it is evident that the majority of cases of chronic renal tuberculosis are primarily located in one kidney, progressing to gradual destruction of the kidney with involvement in the lower urinary tract and often times to the secondary infection of the other side. We should interpret this as an important indication for early investigation and prompt removal of the tuberculous kidney.

Considering the primary lesions in the body, which are associated with renal tuberculosis and often its cause, it has been shown by Braasch, in the large series of cases from the Mayo Clinic, that about 30 per cent show pulmonary involvement. Our series seem to show a much higher percentage of pulmonary lesions and approaches 50 per cent. Bone and gland involvement are found in a small percentage, but genital lesions, namely, epididymitis, prostatitis and vesiculitis occur in 70 to 75 per cent. In Braasch's report, 25 per cent had epididymectomy, either before or after nephrectomy—in mine 15 per cent. These associated lesions, according to the best authors, and substantiated by my findings, seem to have little or no effect on the ultimate prognosis of nephrectomy, provided they are not too active.

Paths of infection. There has been considerable discussion as to the mode of infection of the tuberculous kidney and at the present date, there is no exact unanimity of opinion. The original idea that tuberculosis of the kidney was due to an ascending infection from the bladder up the ureter has long since been discarded. It is easy to see how this idea should have prevailed, since the bladder symptoms are usually the primary ones and therefore, it was incriminated as the original focus. Furthermore, Albarran in 1892 by injecting tubercle bacilli in the ureter, above a site of ligation, was able to produce renal tuberculosis. Wilboltz offered experiments to show that kidney tuberculosis could be produced by injection of tubercle bacilli in the unobstructed ureter, but the kidney involvement

which he obtained showed the lesion in the medullary substance of the kidney, which does not substantiate ureteral transmission. The masterful work of George Walker showed definitely that ascending infection up the unobstructed ureter did not occur. Halle and Moltz claimed to have never found a clinical or anatomical fact which would tend to establish the reality of an ascending tuberculous infection. Bauereisen states that with the flow of urine unobstructed, tubercle bacilli cannot reach the kidney intra-ureterally. Lymphatic infection has many advocates and probably is the route of infection in certain cases of tuberculosis. Bromgersma is a strong advocate of this path of transmission and has demonstrated at autopsy, the extension of tuberculosis from the apex of the lung through glands along the aorta through the diaphragm to the kidney. Infection along the ureteral lymphatics, both in tuberculosis and non-tuberculous infection, has certain advocates. At the present time there is not sufficient proof to warrant a general acceptance. Most authors concur in the belief that the usual path of infection to the kidney is through the blood stream, and there is abundant evidence to warrant the conclusion that this is the most universal manner of renal infection. With a small tuberculous involvement within the body, there are frequently temporary bacillemias, it is therefore easy to appreciate how a kidney, constantly filtering organisms, could under certain conditions, become infected. There are also instances of tuberculosis in the substance of the kidney without any evidence of tuberculosis in the urinary tract. As to the exact location of the initial lesion within the kidney, there is dispute. Cabot and Crabtree in their work on renal infections seem to believe that experimentally the earlier lesion is at the base of the pyramid between the cortex and are more common in the tubular region. There is no accepted explanation for the fact that the lesion is at the base of the pyramid—it may be due to the conditions of the tubules in this location, since they are broader and the epithelial cells are supposed to possess phagocytosis or it may be a vascular affair since at this region the arcuate divide into the interlobular and arteriolae rectae. It may be possible that the change to vascular

pressure in this territory may have something to do with it. I have recently observed a kidney which offers evidence that this region is the primary site of infection.

I removed a kidney from young woman, who had suffered a very short time with severe bladder symptoms. She had typical cystoscopic evidence of vesical tuberculosis, a pyuria without organisms in the ordinary stain—tubercle bacilli in the pus from the bladder and from the right kidney. The process was very acute. The kidney was removed; at operation it was perfectly normal in appearance. The ureter showed not the slightest indication of any involvement—kidney was free and movable. On section it looked perfectly normal, except that on careful search in the center of the kidney at the base of one of the pyramids, the normal smooth appearance was supplanted by a slight granular area. There was not a sign of cavity formation or caseation. On section there was but one small tuberculous focus showing tubercle bacilli in the tissue stain. The process has not undergone caseation, there was no evidence of tuberculosis elsewhere in the kidney. The pelvis looked normal, showed no tubercles even on microscopic section, so we have in this case the very earliest possible lesion of tuberculosis of the kidney located at the base of one of the pyramids. It is quite easy to see that had there been an ulcer in the pelvis of the kidney or around the papillae, a primary tuberculosis of the renal pelvis would have been suspected as in the case of Buerger and I am of the belief that if serial sections were made of kidneys, having these pelvic ulcers, in all probability the initial lesion would be found in the substance of the organ, in the vast majority of instances. This disease is one of early adult life, about 70 per cent occurring between twenty and forty. The average age in our series was thirty-two. Older patients show more of a tendency to autonephrectomy, although within the last month, I removed this type of disease from a patient nineteen years of age. Males seem more prone than females; 60 per cent to 40 per cent in our analysis. It is quite striking that there has been but one colored patient in our series. A positive family history was given in 20 per cent.

Pathology. The progress of the pathological processes in chronic tuberculosis of the kidney is variable, ranging from the very early lesion, as has just been described, to complete destruction and isolation of the kidney. As in tuberculosis elsewhere, caseation is usually present and a reactionary area of sclerosis with a resulting cavity formation. This may remain more or less stationary for some time, but the tendency is to progress gradually and invade the pelvis with the production of a pyelitis and from here to extend by way of the intertubular lymphatics to different parts of the kidney and often to the sub-capsular lymphatics with the formation of tuberculous lesions beneath the capsule of the kidney, frequently extending to the perirenal fat either by continuity or by way of the lymphatics. An extension of tuberculosis from one pole of the kidney to the other may take place by perirenal lymphatics. Some are of the opinion that such invasion of the perirenal fat has great significance in the healing of wounds. It is my personal belief that persistent sinuses, following a nephrectomy for renal tuberculosis, are due to tuberculous involvement of the perirenal fat, and usually do not result from the infected ureteral stump. I have made repeated injections of the sinuses and have always found the tract to run upward to the region of the kidney pedicle and not down to the region of the ureter. The cavities in the kidney may coalesce and form larger ones—along with this process the ureter becomes implicated, ulcerated, sclerosed and strictured with a coincidental pyonephrosis so that the whole kidney may be completely involved. If the process within the kidney is more or less acute and the ureter is quickly blocked, such a kidney may be large and pyonephrotic and often show secondary infection. On the other hand if the process is gradual, the obstruction in the ureter is gradual and complete, the outcome is usually a small contracted, caseated, so called putty kidney. This final process is designated by the term autonephrectomy or tuberculous renal occlusion. Infiltration of lime salts is quite common for which reason the X-ray often serves as an aid in the diagnosis of such a condition. It has been estimated that about 30 per cent of these kidneys give positive X-ray

shadows. In our series, only 20 per cent were positive. In my 97 cases, there have been 16 autonephrectomies. In 1915 when Dr. Greditzer and I reported 7 cases, there had been but 24 previous cases reported in the literature. With improved diagnostic methods, this type of renal disease is becoming more and more common. It is with this type of tuberculous kidney that some men have believed that there was a possibility of spontaneous healing, but in all of such kidneys in this series, tuberculous activity could be demonstrated, and while the bladder symptoms may often times be considerably ameliorated by this renal isolation, I have never yet seen one where they were completely and permanently quiescent. On the contrary they have all been prone to exacerbation and have always demanded surgical intervention. The interesting feature in certain cases of this type of renal tuberculosis is that the bladder urine may be practically clear; the bladder may look almost free from tuberculosis entirely out of proportion to the symptoms, which are almost invariably relieved after the removal of such a kidney. The explanation seems to be that the individual utilizes his resistance to combat the kidney infection, and is unable to completely eradicate the vesical lesion. With the removal of the kidney, healing ensues. Coincident with the lesions in the kidney and usually the first thing that attracts the patient's attention to the disease is the resulting condition in the bladder, namely, a spreading tuberculosis. This usually starts around the corresponding ureteral orifice, in early cases as a tubercle, later caseation and ulceration. In older lesions associated with thickening and retraction of the ureter, the ureteral orifice may be pulled back and held open from sclerosis with a production of so called golf-hole orifice. The process gradually extends and involves the different parts of the bladder wall with disseminated lesions. The dome of the bladder frequently shows early tuberculous changes. Early processes in the bladder are usually superficial and involve only the mucous membrane. Their tendency, however, is to infiltrate and invade the various coats of the bladder and to prevent the normal contractibility and distensibility of the organ. In this disease,

perivesical involvement is extremely common. Secondary infection with marked destruction of the vesical mucous membrane is a frequent sequel. Faced with the probability of such marked destruction of the bladder, with very slight chance of improvement, if left alone, it is easy to see how essential it is to promptly remove the initial lesion. It is for the protection of the bladder that early removal should always be insisted upon. If we are able to remove the focus before the deeper coats of the bladder are involved, the results of bladder function are excellent, the more the coats are implicated, the more difficult and more uncertain is the chance of complete cure of bladder symptoms. While it is the opinion of some that patients do surgically better if the tuberculosis has been present for some time in order that the individuals may become vaccinated, one is certainly not warranted in delay in operation for such vaccination. My experience convinces me that there is very little weight to such an argument, as far as results to the kidney and patient, as a whole, are concerned, and any delay affords a chance for more disturbance in the bladder and this organ must be protected.

I recently saw a complication of vesical tuberculosis, which is of such variety as to merit mention, occurring in a young girl, twenty years of age on whom I had removed an acute secondarily infected tuberculous kidney four years previously. She gradually improved in general health and of her bladder symptoms, although the latter were never entirely relieved. She was suddenly seized with a severe pain in her hypochondrium and a desire to urinate; could pass but a small amount of urine without relief; was seized with a chill and high reactionary fever, continued voiding in small amounts and in forty-eight hours developed a mass above the left anterior superior spine. I saw her at this time and found a fluctuating tender mass in this region which I opened and evacuated considerable pus and urine. On filling the bladder with solution, it was found to flow freely through the opening; patient was also suffering with pain and tenderness in her left and only kidney. The X-ray showed a group of shadows in the lower pelvis near the bladder region, kidney and upper ureter were negative. Several days later the cystoscope

revealed a large opening on the posterior wall of the bladder in the center of the ulcer which was present on her previous admission four years ago. Before this I had thought that it was probable that the leakage was a reflex up the ureter on the side of the previous nephrectomy. The ureter catheter passed up this ureter and found it to be completely blocked, no fluid could be injected through it. Catheter was passed up the left ureter, showed a large retention of clear fluid in the left kidney. With X-ray catheter in the sinus, one can see from illustrations that it curled up and back of the bladder at the site of the retrocystic abscess. A pyelo-ureterogram was done which showed a large uretero-hydronephrosis with stricture at the juxta-vesical ureter, around which the shadows seen on previous X-ray plates were visible. Dilatation of the stricture failed to relieve the condition, and in order to protect the kidney against further destruction from back pressure, since the ureter catheter drainage had failed, a nephrostomy was done and the ureter ligated just below the kidney with no. 2 plain catgut. This was done not only to protect the kidney but to protect the bladder against influx of urine from the ureter in order that the bladder might heal. Patient did very nicely after the operation; the sinus ceased draining urine—she left the hospital in good condition in a short time, but I have been unable to trace her since, as she moved to another city. I cite this case on account of the extreme rarity of spontaneous rupture of the tuberculous bladder; furthermore on account of the method which was done with an attempt to healing of the bladder and spare kidney. From the experimental work on ureteral ligation, which I reported in 1919, I am convinced that the ureter will ultimately open and that the normal channel will be restored, provided the lower ureteral stricture is relieved by dilatation.

Before discussing the symptoms of renal tuberculosis, allow me to call your attention to the fact that the duration of symptoms in the cases studied, ranged from one month to twenty-three years, with an average duration of twenty-one months, nearly two years.

From the description of the progressive pathology, it can be seen quite clearly how advanced lesions and generalized involvement are apt to occur during such a protracted period, therefore, the most important problem facing us in this disease is a thorough appreciation and prompt treatment of the condition before such lesions are allowed to progress. We must then be thoroughly acquainted with the symptoms of renal tuberculosis in order to ward off this late result.

Symptoms of renal tuberculosis are primarily and chiefly vesical. In analyzing our 97 cases, frequency of urination occurred as the initial symptom in 85 per cent. Kidney pain was present as a beginning symptom in less than 20 per cent, but was present during the course of the disease in 48 per cent,

Painful urination, particularly terminal pain, was present in 48 per cent and hematuria was present in 38 per cent. There were two patients who had hematuria without other symptoms. These were supposed to be the so-called essential or idiopathic hematuria, since they occurred without any evidence of any other disease. Tuberculosis was found only after a thoroughly pathological study of the kidney. The usual history is that a young individual begins to have vesical symptoms such as frequency, burning, pain, terminal hematuria, resisting medication, aggravated by silver or internal urinary antiseptics of the formalin variety; with periods of remission and exacerbation. With such exacerbation the symptoms become progressively worse. We gather from this the axiom that an unobstructed bladder in which stricture, prostate, stone or gonorrhea cannot be demonstrated and which fails to promptly subside within a week or ten days of local treatment, is usually tuberculous and complete investigation should immediately be undertaken. A recent experience illustrates how important such an investigation is and how serious operating upon such a bladder may be. A patient appeared, who had had a suprapubic cystostomy done nine months previously for considerable bladder distress. After this long period of drainage, his bladder was still extremely irritable and the fistula persisted in spite of repeated attempts to try to close it. I found that he had a large tuberculous autonephrectomy.

This I removed and in two weeks the fistula healed promptly without anything being done to it. Several months after the removal of this almost completely isolated kidney, the patient has a normal bladder function. There seems to be some misunderstanding about the general condition of the individual. One looks for all these patients to be physically disturbed before being suspicious of tuberculosis. In our analysis 55 per cent of of the patients were in good condition and 45 per cent in poor condition. The poor group was due to the fact that they were individuals who had either bilateral renal involvement or general tuberculosis—29 per cent of our cases were bilateral, so we see that the great majority of the unilateral renal tuberculosis are in patients who otherwise seem physically fit and often fat.

Diagnosis. The diagnosis of renal tuberculosis offers no particular difficulties with the exception of harmonious practice between physicians and specialists and occasionally mechanical ones. I shall not go into exact detail of the various methods because you are all familiar with them, but will cite them briefly.

Symptomatology as previously outlined is highly suggestive—a hazy limpid urine with occasional red blood cells or considerable pus without bacteria in ordinary stains is very suggestive of tuberculosis. Such urine should be stained for tubercle bacilli and if a careful search is made, the organisms should be found in at least 75 to 80 per cent of all cases. I do not believe there is any necessity of special methods of fixation as an ordinary smear well fixed, after thorough centrifugalization and recentrifulization, is all that is necessary. With careful technique, smegma bacillus should seldom cause any differential troubles. This is particularly true of specimens obtained by the ureter catheter directly from the renal pelvis. In bladder specimens it is important to thoroughly cleanse the meatus, irrigate the urethra and have the patient void in three glasses, taking the last in a sterile glass for study. I believe this is better than catheterization. Guinea-pig inoculation is extremely helpful but unnecessary if the organisms are found and inconvenient because of the time necessary for the test. Guinea-pig inoculation is not infallible, since about 3 per cent of the findings are negative in

positive tuberculosis. I feel that the cystoscope usually offers the most important means of diagnosing vesical tuberculosis and certainly, all will agree, in localizing kidney tuberculosis. With the appearance of the lesions, described under pathology, the trained cystoscopist can almost invariably make a positive diagnosis. Therefore we rely more on the cystoscopic examination than anything else in the ultimate diagnosis of renal tuberculosis. The X-ray will show positive evidence in from 20 to 30 per cent; usually late cases seldom of any value in the early ones—the ones we really need.

Pyelography is often of great value, but in the very early cases, with little or no pelvic involvement, it serves no information. It shows, however, a typical finding, and that is, a fringing of the renal pelvis and ureter, a condition which is seldom seen in anything else. A pyelogram done about a year ago showed a complete cutting off and filling defect of the upper calyx, which gave the impression of tumor but was found to be tuberculosis.

Interesting complications and lesions. There have been in this series several exceptional and interesting complications. I have discussed spontaneous rupture of the bladder—besides this there has been one case of tuberculosis associated with cancer of the bladder—one of tuberculosis and true stone in the kidney and this the only kidney; the other having been removed several years previously for an acute pyonephrotic tuberculosis. The presence of a true stone, not a lime salt infiltration, in a tuberculous kidney is extraordinarily rare, and its removal, so far as I can determine, has been reported but once by Fowler of Washington. There are points of interest in this case, I should like to cite. In the first place, the stone about the size of a large cherry stone, hard and smooth, was removed through a pyelotomy incision. Surgically, this is of interest because there was prompt healing without the slightest leakage of urine from the pelvis, so that in spite of renal tuberculosis, one may hope for pelvic healing. Another interesting fact about the case was that at the time of the operation, the kidney surface was studded with innumerable sub-capsular tubercles. This kidney was exposed to the air for

quite a time, hoping for some beneficial effect in healing—patient made an interrupted recovery, and aside from her bladder symptoms, which had somewhat improved, she was in perfect health. Two years later she had recurrent stone in the kidney. I did another operation on this single kidney—there were dense adhesions between the kidney and fascia and with very gentle manipulation, the moment I touched the kidney with my finger, it ruptured almost completely transversely into the pelvis—hemorrhage was not alarming. The two parts of the kidney were then easily freed. It was noted that the tubercles, which had been on the surface of the kidney previously had entirely disappeared, leaving occasional pale scars. The stone was removed from the pelvis of the kidney through the site of rupture. The kidney was sutured completely from the anterior part of the pelvis around the kidney to the posterior part. Patient made an excellent recovery without the slightest complication. We learn from this that direct exposure to sun light and air may have a beneficial effect on kidney tuberculosis, similar to peritoneal involvement. Another lesson is, that a complete rupture into the pelvis of the kidney should be conservatively treated.

I have operated on single tuberculous kidneys three times. Another patient, who had a previous nephrectomy three years before, came in with intolerable bladder symptoms due to tuberculosis of the other kidney. She resisted all treatment to the bladder and for this reason, a nephrectomy and ureteral ligation was done. She has had complete relief from her bladder symptoms; has had more or less stormy time with her renal drainage but now, a little over a year since this operation, she has greatly improved. Nine months after ligation, the patient began to void. My impression was that a ligated tuberculous ureter would not open up in contradistinction to the non-tuberculous uninfected ureter, which will always open up. This ureter, however, has never been opened, and I dare say, it never will.

Another patient had been treated for hip disease for a long time. There was a completely occluded kidney, a large cheesey ureter, densely adherent to the psoas muscle, which explained her pseudo hip disease. The kidney and ureter were removed entire—patient's gait has become practically normal.

Another recent complication of tuberculosis that I have seen in a young girl, is a complete impermeable stricture of the urethra with incontinence. The whole urethra was almost a solid stricture. This is a recent case and I have worked for several weeks to gradually dilate this contracture. I have been able to get the anterior part open, but immediately at the bladder neck, I have been unable to get even a filiform through.

Surgery. The most important feature in the surgical outlook of the tuberculous subject, is the finding of a unilateral tuberculous kidney and finding it early before the late results have become manifest.

Some authors advise the removal of the most diseased kidney in bilateral tuberculosis; I have done this several times, but have always met with disappointment. Tuberculosis has always progressed in the other kidney and the bladder symptoms have never improved. In bilateral tuberculosis, surgical efforts do little, except for renal drainage to protect a seriously bothered bladder.

Influencing factors in surgery are numerous—in the first place the anesthetic. Since so many of these patients have pulmonary involvement, it is important not to subject their lungs to irritating anesthesia. For this reason, gas and oxygen is unquestionably the choice of anesthetics. In all of our cases, it has been used. Few had to have a certain amount of ether for early relaxation. In this way the lungs are protected against the untoward consequences of an ether anesthetic, so that with gas and oxygen, pulmonary complications should be reduced to a minimum. We have had three such complications in the 55 nephrectomies for tuberculosis—only one of which was at all serious.

The length of operation is very important—the usual time in our cases was forty-five minutes. Most of the early cases took well over an hour. The more recent cases have been completed within thirty-five minutes; a number of cases under a half hour.

The position of the patient is one of the most importance. Patient should always be with operative side elevated, with an arm and leg extended, side straightened out. In this way, the

patient's lumbar region is put on tension, so that there is considerably more room given, and retraction is seldom necessary. In the last few years we have seldom put retractors in the wound, except to push back fat; never for heavy pulling. The incision should be free, going up to the angle of the rib in deep fascia in order that the rib may be mobilized and extending as far down and forward, as is necessary for free access. If one has free exposure, nephrectomy is usually without much difficulty. It is extremely important not to handle tissues roughly. Gentle manipulation of the kidney and perirenal fat must be done to protect against rupturing tuberculous abscess in the kidney, and of squeezing out through the lymphatics, materials from the kidney. Certainly delicate handling of tissues plays an important rôle in the healing of the tuberculous wound.

Careful dealing with the perirenal fat is very important, since it has been definitely shown that many of the persistent tuberculous sinuses are due to infection in the remaining fat. As far as possible, this fat should be removed at the operation and one will have much less trouble with the healing wounds.

Great care should be exercised in stripping the pedicle, and also in stripping back the peritoneum—pedicle should be entirely freed of fat, clamped en masse low enough down so that the kidney may be removed without opening the pelvis. Since the ureter is usually thickened and adherent, it is much easier if this is at first ligated and incised with cautery—in this way the pedicle is much more easily exposed. It is not wise in ligating the pedicle, to try to separate ligation of the vessels. I have saved a great deal of time in applying a large pedicle clamp, immediately excising kidney above it, leaving enough of the vessels exposed so that each vessel may be caught above the clamp with the other forceps, then with a double long no. 2 catgut stitch, the pedicle is ligated with a figure eight suture. In this way, the pedicle is fortified in three ways, so that slipping is impossible.

Treatment of the ureter varies with different cases—it depends more or less on the type of ureter, although I must say that it has not mattered very much in our cases. Many are amputated

as low down as possible and not drained. It is useless to try to remove the entire ureter, since it heals with the bladder after the removal of the kidney. If one tries to remove the ureter, the most important part has to be left, that is, the intramural part and most men feel that such removal is unnecessary, and I am sure, I do.

Concerning the closure of the wound, many are closed with drainage. I see no particular difference in the ultimate healing. Most of the wounds close completely within two months, although some have gone much longer. There has been but one wound which opened completely, and this occurred four weeks after operation, after it seemed completely healed. Exposure to sunlight immediately hastened the healing in this case.

Concerning the operative complications, we have had hemorrhage during operation but twice, once a small aberrant vessel to the lower pole was torn, and in the other instance the clamp slipped off one of the branches, but it was immediately caught. In using the present technique, such a thing should not occur. The peritoneum has been nicked twice with no bad result. There has never been a peritonitis, neither pleura nor bowel have been injured. I have never had to resect a rib, and with proper position and incision, it will not be necessary.

There has been but one case of shock, this was not severe and occurred in a young girl with a very large tuberculous pyonephrosis. Shock in kidney work is rare, if one is careful in technique.

Vomiting and distension have not been troublesome. Only six patients vomited after the first day and distention was present in but two instances. These patients have averaged getting up in chairs on the twelfth day. The average day of discharge from the hospital has been the twenty-fifth. This is made rather high on account of several cases, which were extremely long in their convalescence.

We have had but one case of meningitis, and this occurred several months after operation.

Relief of bladder symptoms. It is hard to predict. Lower laid down the rule that the bladder caused the patient trouble as

long after operation as it had before. Braasch claims that the relief of bladder symptoms is proportionate to the severity of the lesion. As a general working rule, this is true and has been so in our cases, but I have seen a number of cases, and two within the last month with severe tuberculous pyonephrosis, extremely bad bladders of long duration which immediately cleared, upon removal of the kidney. This is a very interesting thing. It could not be that the ulcers have been improved, it must be due to some toxicity in the pus from the tuberculous kidney. Two patients whom I operated on last month, who had urinated every fifteen minutes for the last year, showed most astonishing improvement—one could go three hours and the other one, two hours, immediately after the operation; urination then became more frequent, that is, an hour to an hour and a half intervals.

Tuberculin after operation has been of great value in these cases. It seems to hasten the healing of the wound and the amelioration of bladder symptoms. For the painful bladder, I know nothing more effective than the mercurochrome solution. It seems to offer much more relief than any other therapeutic agent. Such patients are all put in the sunlight and under the usual tuberculous hygiene as promptly as possible.

Mortality. Immediate mortality, Mayo Clinic, is 1.3 per cent; Massachusetts General 3 per cent. The average mortality among other operators is much higher; ranges around 7 to 10 per cent. I have had no deaths in my series of 55 cases. The late mortality, according to most authors, is 20 per cent within five years and in bilateral cases, 75 per cent within a year. Fifty per cent of our patients, who had bilateral renal tuberculosis died in the hospital without surgery. We may expect a positive cure in 60 per cent or 70 per cent of unilateral cases. Therefore, unilateral renal tuberculosis should be subjected to immediate nephrectomy with the hope of a very high percentage of cures, with the anticipation of a very low mortality rate and with a good chance of ultimate cure of the disturbing bladder symptoms instead of the almost positive decline into invalidism, if left to medical treatment.